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THE MILITARY SURGEON

MEDICINE

JOURNAL OF
THE ASSOCIATION OF MILITARY SURGEONS
OF THE UNITED STATES

EDITED BY
JOHN VAN R. HOFF

VOLUME XLII

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WASHINGTON, D. C.
THE ASSOCIATION OF MILITARY SURGEONS
OF THE UNITED STATES
1918

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THE MILITARY SURGEON

VOL. XLII JANUARY, 1918 NUMBER 1

ORIGINAL ARTICLES

Authors alone are responsible for the opinions expressed in their contributions

TRANSPORTATION OF WOUNDED

BY CAPTAIN JOHN GILMOUR, M. C., R. A. M. C.

(With seven illustrations)

SINCE the beginning of history, tribes, races and nations have been fighting battles and, although they have left records in the shape of pictures and descriptions of their victories and losses, very little is recorded concerning their wounded.

Till the end of the eighteenth century it was the custom for the medical personnel to be stationed behind the army. While the battle lasted the surgeons attended to those who made their way back to them or were brought in by their unwounded comrades.

After an engagement the wounded were often left on the field of battle to be looked after and nursed back to health by the civilian population of the district.

Barons Larrey and Percy, surgeons in Napoleon's army, were the originators of an organized system for prompt aid to the wounded in war. In 1792 Baron Larrey made a proposal for the establishment of a field hospital capable of active service in front with the advanced troops of the army. This was accepted and the movable field hospital ("Ambulance volante") was organized. These were used in the French Army in the campaign against Austria. It was about this time that companies of stretcher-bearers were organized by Baron Percy, also of the French Army. These institutions seem to have answered their purpose at the time they were employed and were spoken of with praise by general officers on several occasions. In April, 1800, General Lecombe published this general order: "The medical officers have succonred the wounded on the field of battle itself, and have so distinguished themselves by their zeal and devotion that the soldier reverences them and consoles himself when he is wounded because he sees that assistance is given to him with a rapidity hitherto without example."

Another half-century elapsed before the system of collection and

evacuation of wounded by trained stretcher-bearers became general in the armies of Europe. The British commissioners at the French headquarters in the Crimea, in a report on the military transport, stated that: "The transport of the wounded from the field of battle to a good ambulance, besides satisfying the rights of humanity and sustaining that spirit of confidence in the soldier which, like discipline, should never leave him, has another admirable effect. It obviates the incalculable disadvantage of troops engaged in action leaving their ranks for the purpose of carrying off the wounded."

During the Civil War there was an insufficiency of bearer personnel. In a letter to the Secretary of War, Surgeon General Hammond, writes in 1862: "In accordance with your verbal permission, I have the honour to submit the enclosed project for an hospital corps and to ask your favorable consideration for the same. The need for it is most urgent. In no battle yet have the wounded been properly looked after; men under the pretence of carrying them off the field leave the ranks and seldom return to their proper duties."

The importance of a well-organized transport for wounded cannot be over-estmated. The safety of lives and the preservation of limbs depend upon the proper means of transport being at hand. The period which elapses between the time a soldier is wounded and the time he returns cured to his unit will be shortened if the transport is so organized that the wounded man is brought with the least possible delay under the required surgical care. In addition the speedy removal of wounded during an engagement is not without influence on the combatant ranks generally. The soldier is relieved of a certain amount of anxiety when he knows that assistance is close at hand if anything should happen to him. The presence of large numbers of wounded lying on the field of battle has an injurious effect on the morale of fresh troops which are marching up to reinforce or relieve the troops already in action.

In the present war the problem of transportation of wounded must be tackled and organized weeks and months before the battle actually commences. No one system can be laid down which will be applicable to the western front. In describing the transportation of wounded in modern warfare it will be simpler to describe how the transport is organized and the methods of transport in use on the western front.

The British Expeditionary Force is administered and organized by armies; these are divided into several corps and each corps is made up of two or three divisions. With the headquarters of an army is a director of medical services who is responsible for all medical arrangements in the army. At the corps headquarters there is a deputy director

of medical services and with a division is an assistant director of medical services. Each of these officers is responsible to the general commanding the formation, that the medical organization proceeds smoothly.

When a battle takes place on the western front one or two armies may be engaged, and close coöperation between the staff of the army, corps and division is required to insure that a regular evacuation of wounded takes place. The assistant director of medical services makes his arrangements to get the wounded of his division from the firing line to the field ambulance. The deputy director of medical services of the corps removes the wounded from the field ambulances to the casualty clearing station. (The casualty clearing station in the British Army corresponds with the evacuation hospital in the American Army.) The director of medical services at the army headquarters arranges for hospital trains to clear the casualty clearing stations to the general hospitals at the base.

The assistant director of medical services of the division, in making his arrangments for the transport of the wounded from the front line to the field ambulances, must work closely with the other divisional staff officers. He must obtain sufficient personnel to act as stretcher-bearers. He must know which are "up" trenches and which are "down." Trenches cannot be blocked by wounded being carried down when troops and ammunition are being taken up. He must know the routes of the trench tramways and Decauville railways so as to utilize these important methods of transport and so avoid long carries by men. He must arrange for the use of the empty returning trucks, so he must know when ammunition, etc., is being sent up. In the event of an advance, these light railways and trench tramways are pushed on behind the troops; he must therefore know where they are going and arrange his collecting posts at the most suitable sites. If it is possible to use roads, he must know which roads are suitable for motor transport and which for horse-drawn transport. All routes must have proper directing posts or flags at crossings so that the unaccompanied, walking, wounded men may know which way to go. All medical posts must be distinctively marked.

The deputy director of medical services at the corps headquarters arranges for the transportation of wounded from the main dressing station to the casualty clearing station, and also assists by sending extra transport to clear the wounded from the advanced dressing stations to the main dressing station if any strain or congestion is occurring at any point. He also arranges for the evacuation of the lightly wounded from the "walking wounded post" to the casualty clearing station. This is done in conjunction with the staff officer of the Quartermaster

General's branch of the general staff at the corps headquarters. This evacuation is carried out by means of motor omnibuses, char-a-bancs or trucks. In field service manuals, empty returning supply wagons are directed to be used for bringing back lightly wounded men, but in actual practice, and in the first two or three days of the battle, these supply wagons are not there. Sufficient rations have already been brought up to last two or three days, and it is in the first few hours of the battle that the largest number of lightly wounded men are met with. During this time motor char-a-bancs and omnibuses are fully occupied bringing up fresh troops, and the number of these vehicles which can be allotted for the transport of wounded is not sufficient to complete the evacuation unaided. This fact must be kept in mind when choosing the site for a "walking wounded post." It should be, if possible, close to a main road so that the empty returning transport may be made use of. Empty returning ammunition trucks are usually available after the first few hours.

The route to be taken by the motor ambulance cars between the advanced dressing station and the main dressing station and between the main dressing station and the casualty clearing station must be worked out in conjunction with the assistant provost marshal at the corps headquarters. He is the officer responsible for the regulating of traffic on the roads, which are always congested during active operations. Ambulance cars should never be allowed to run in convoys; single cars are much easier to handle by the traffic officers. They can be passed through a body of marching troops without halting the whole column, and they are much speedier when running alone.

Ambulance cars should always be fully loaded up before being sent off. The evacuation will break down during active operations if the accommodation is not utilized to the utmost.

The evacuation from the casualty clearing station to the base by means of hospital trains is arranged by the director of medical services with the director of railway transport at the army headquarters. This is the most important link in the chain of evacuation. Any breakdown here will affect the whole of the evacuation scheme and the casualty clearing stations and field ambulances will be crowded out with wounded.

During periods of inactivity when the normal trench warfare is in progress, the evacuation of wounded is easy and rapid except for unusual local conditions. When a man is hit in the trenches the stretcher bearers go to his assistance. The first field dressing is applied and the man is accompanied or carried to the headquarters of the medical officer in the battalion aid post. This is a dugout in the second or third

line of trenches. From there he is taken by the battalion stretcher-bearers to the advanced dressing station, or, if the distance is great, to a collecting post. This part of the journey is made by hand carriage or trench tramways by the battalion stretcher-bearers. From the advanced dressing station or the collecting post the field ambulance takes charge of the wounded man. If his condition is not serious he may be detained till night, when it is possible for motor ambulances to come up and evacuate the wounded. If the condition of the wounded man is so serious that he cannot be detained, he is taken by wheeled stretcher to the nearest point to which an ambulance car can advance without attracting the attention of the enemy and from there to the main dressing station of the field ambulance. This stage of the evacuation is performed by the ambulance cars of the field ambulance. From the main dressing station to the casualty clearing station, the cars of the motor ambulance convoy do the transportation. This evacuation is arranged at fixed hours once or twice a day. The officer in charge of the field ambulance notifies the commander of the motor ambulance convoy how many patients he has requiring transportation, whether they are officers or of other ranks, and how many lying and sitting. The motor ambulance convoy removes infectious cases once a day from the field ambulance to the special infectious hospital.

The methods of transport in use on the western front may be classified as follows: (1) by men, (2) by conveyances carried by men, (3) by conveyances wheeled or drawn by men, (4) by conveyances carried by animals, (5) by conveyances drawn by animals, (6) by mechanical transport, (7) by railway transport, (8) by water transport.

1. BY MEN

One soldier can assist in the removal of another by any of the following means:

1. *In the arms.*—If the wounded man is not too heavy he can be carried like a baby. The left arm is passed under the knees and the right arm is placed round the waist of the injured man, who puts his arm round the bearer's neck. If the injured man is unable to stand it is almost impossible to lift him into this position unaided.

2. *Pick-a-back.*—If conscious and able to hold on, the injured man climbs on to the back of the bearer, who kneels on the ground.

3. *The "Firemen's lift."*—This requires great physical strength to get the patient into the proper position, but is very useful in carrying a helpless or unconscious man over rough ground.

4. *By pulling along the ground.*—It is sometimes necessary to pull an injured man into cover. This is done by passing the hands below

the armpits, raising him and pulling him along head first. If more than one bearer is available the wounded man may be carried by means of—

(*a*) *The fore and aft carry.*—One bearer, kneeling behind the injured man, passes his hands below the man's armpits and clasps them in front of his chest. The other bearer stands between the patient's knees and, bending down, catches hold of them. Both bearers then rise together.

(*b*) *The two-hand seat.*—The bearers stand on either side of the wounded man and each passes a hand below his buttocks, hooking their fingers together beneath him. Each bearer places his disengaged hand on the other bearer's hip so forming a back support.

(*c*) *The four-handed seat.*—Each bearer seizes his left wrist with his right hand and by grasping the wrist of the other bearer with the disengaged hand, a square seat is formed. The patient should have his arms uninjured for this method of transport, as he is required to hold on by passing his arms round the bearers' necks.

If three bearers are available, the bearers place themselves on one side of the injured man, kneel beside him, one bearer passes his hands below the man's knees, another below his hips and the third supports the chest and head. All then rise together.

2. BY CONVEYANCES CARRIED BY MEN

The stretchers in use on the western front are the Ambulance Stretcher Mark 11, and the trench stretcher. Improvised stretchers are seldom seen and should never be necessary if adequate arrangements have been made beforehand. The ambulance stretcher is 7 feet 9 inches long overall, 1 foot 11 inches wide, and weighs 30 pounds. It is similar to the litter in use in the United States Army.

Normally sixteen men are attached to each battalion medical officer as stretcher-bearers. These men are drawn from the battalion. They carry no arms while employed as stretcher-bearers and are trained in first aid. Formerly the bandsmen were trained for these duties, but battalion bands no longer exist. During periods of active operation the number of stretcher-bearers requires to be greatly increased. Prisoners are also used to carry wounded to the advanced dressing stations. No work is heavier than stretcher carrying for long distances and over difficult ground. Immediately after an advance, long carries are always necessary as the roads are completely smashed up by shell fire and impassable for wheeled transport.

It is essential that a sufficient number of stretchers be available for all casualties requiring them. To insure this, numbers of stretchers

must be collected in dumps at all medical posts so that when the bearers bring down a loaded stretcher an empty one is taken back by them. During a battle the wastage in stretchers is considerable. It is not advisable to move a man from a stretcher on which he is first placed until he occupies a hospital bed. Similarly, ambulance cars which bring down stretcher cases are returned with the same number of stretchers. This applies also to blankets, hot water bottles and Thomas splints.

The stretcher is carried by two bearers who walk "out of step" to prevent the stretcher swinging. The stretcher should never be carried on the shoulders. Owing to the length of the stretcher it is often impossible to carry it loaded along a narrow trench and past the projecting traverses, in consequence the trench stretcher has been introduced. On this the patient assumes a semi-recumbent position, with the feet hanging down. Owing to its short length it is easily carried round sharp corners. It is not popular with stretcher bearers. Trench stretchers are not used when wounded can be carried above ground.

Improvised stretchers have been made in various ways:

1. *The Blanket Stretcher.*—This is improvised by means of two rifles and a blanket. The blanket is first placed under the patient. A rifle is then placed on the edge of the blanket on each side of the man and rolled up in the blanket till the rifles covered by the blanket touch him. The butt ends of the rifles should be at the patient's head. When the stretcher is lifted the patient's body is level while the legs hang down. A similar contrivance can be made by means of a pair of puttees instead of a blanket. The puttees are knotted to the rifles and form nine cross bends from muzzle to butt. The rifles are about 15 inches apart.

A temporary trench stretcher can be made of a tunic and two rifles. The sleeves of the tunic are turned inside out and the tunic buttoned up. A rifle is now passed down each arm hole and the stretcher is ready for the patient. The great coat may be used for the same purpose.

An ingenious trench stretcher has been designed by Captain Stirling, Royal Army Medical Corps. This stretcher is very light, simple, cheap and easy to make. The construction of the stretcher prevents the patient from slipping. Both bearers have their hands free to steady themselves when passing along a slippery trench. The stretcher is constructed of strong, broad webbing, and is composed of two sets of braces and a body. There are no poles. It can be folded and carried in a haversack. It is operated by two bearers.[1]

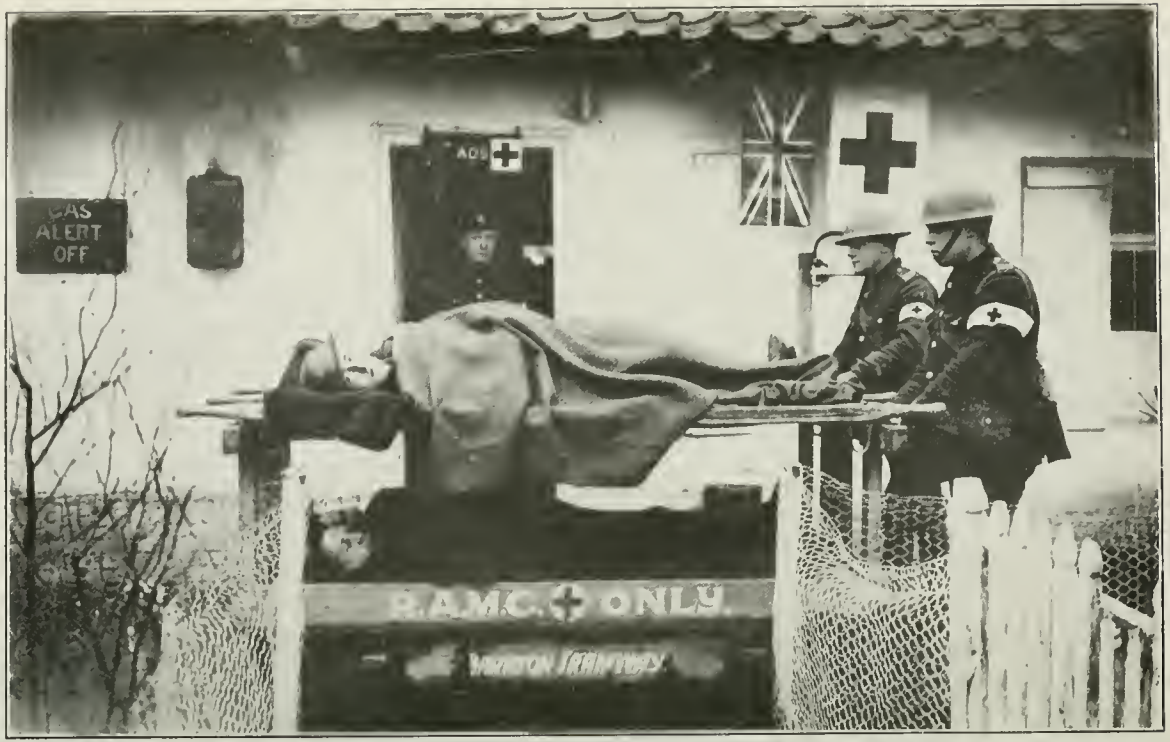
[1] *R. A. M. C. Journal*, Vol. 28, page 496.

3. BY CONVEYANCES WHEELED OR DRAWN BY MEN

In trench warfare the distance between the medical aid post of the battalion in the line and the advanced dressing station of the field ambulance may be as much as two miles. The journey is made for the greater part down the communication trenches where careful walking is necessary. These trenches have a flooring of duck boarding which is about half the width of the trench. In muddy weather this becomes slippery, uneven, and often broken, with the result that some contrivance becomes necessary to assist the stretcher bearers and make the transit safer for the wounded men. Wheeled stretcher carriers can only be used in wide trenches where the duck board flooring extends the whole width of the trench. Single wheeled stretcher carriers have been devised which are pushed like a wheelbarrow, but the stretcher bearers dislike them as the wheel is apt to skid off an uneven duck board and if the wheel is placed in the middle of the stretcher it requires two bearers to balance the contrivance. Trench tramways are used to a large extent on the western front. There are two gauges, two feet and one meter gauge. These tramways do not reach the battalion aid post but the distance between them is not great as a rule. On the two foot gauge tramway, light trolleys carrying two stretchers are used to transport wounded. These trolleys are wooden frames on a four wheeled bogey. The stretchers are carried one above the other. The trolley is pushed by two stretcher bearers. The one meter gauge tramway runs in the sunken roads, and over the open ground and can take trolleys carrying four stretchers, two above and two below. They are heavy to push but the work is much lighter than carrying the stretchers by hand. The later part of the journey may often be made on the road and here wheeled stretcher carriers are used. Wheeled stretcher carriers offer a small mark to the enemy and can be used during the day where it would be impossible to bring ambulance cars. There are several patterns of wheeled stretcher carriers. The old pattern, the Brooke-McCormack, consists of an under carriage made up of two light wheels with steel spokes and solid rubber tires. On the axle are two eliptical springs to which is attached a light wooden framework forming the carrier proper of the stretcher. To this the stretcher is clamped. Two iron supports are provided, one at each end and on opposite sides of the carrier. These are lowered when it is desired to place the stretcher on the carrier or to remove it. The carriage meanwhile remains perfectly still. When the carriage is in motion, the iron supports are turned up and lie along the respective sides of the carrier where each rests in a small clip. The carrier is not strong and the wheels are inclined to buckle on bad roads.

(To face page 8.)

AMBULANCE CARS ON TEMPORARY RAILWAY



Outside an Advanced Dressing Station

Flagstaff, Advanced Dressing Station.

A Loaded Stretcher, in the Trenches.

Detachable Wheels for Stretcher

Overhead Trolly in the Trenches

Dressing a Wound in the Open

The more modern type is much stronger. It has bicycle wheels with pneumatic tires. The axle is hinged so that the wheels can be approximated to save space in storing or packing. It is well sprung and stands rough usage well.

The Lewis gun carriages which are no longer used by the British Army have been modified to form stretcher carriers. All superfluous parts are removed, leaving the wheels, axle and iron framework. To the framework are fitted springs and a wooden carrier in which the stretcher rests. They are very strong and have proved useful.

The only contrivance on the western front drawn by men along the ground is the "mat stretcher." This has been improvised as a result of the modern condition of warfare. It is used to draw out men who have been injured in tunnelling, mining or countermining operations, where the tunnel is too low to allow a stretcher to be carried. It consists simply of a thick mat made of vegetable fiber about 8 feet long; at one end are two rope loops. The injured man is placed on the mat and is pulled out of the tunnel by means of the rope loops.

4. BY CONVEYANCES CARRIED BY ANIMALS

It is possible to transport wounded either lying or sitting on mules. In the first case stretchers are used, in the second cacolets. The method is used by the French Army where the ground is hilly and wheeled transport impossible. It is uncomfortable for the wounded as they are much shaken; also the animals are liable to slip and fall when going over difficult tracks.

Cacolets are chairs which are constructed so as to be hooked on either side of the pack saddle of a mule. They have a framework of iron with a movable back rest to which is fixed a band which is passed round the patient. At the outer side is an arm rest. There is also a foot rest. These parts fold together close up to the side of the mule when not in use. The wounded are seated parallel to the animal and facing the same direction.

The stretchers for mule transport have an iron framework to which canvas is laced. They are suspended in pairs at the sides of the mule. They require to be carefully loaded and balanced.

The authorized load of a pack mule is 160 pounds, so that it is impossible to transport two wounded men in cacolets or litters any long distance.

5. BY CONVEYANCES DRAWN BY ANIMALS

At the beginning of the present war in Europe, the horse-drawn ambulance wagon was the chief means of transport of wounded in the British Army. These have been largely replaced by motor propelled

vehicles and it has been proposed to abolish them entirely. At present in each field ambulance there are seven motor and three horse-drawn ambulance wagons; the latter are used chiefly to collect sick from camps near the field ambulance station. When active operations are in progress they often advance close up to the line at night and bring down wounded. It is said that the horses are able to avoid the shell holes on the roads in darkness. If the leading pair drops into a shell hole the consequences are not so serious as a similar accident to a motor ambulance car. It is a slow and uncomfortable method of transportation and quite unsuited for modern warfare. No horse-drawn vehicles could now deal with the numbers of wounded after a heavy fight unless they were so numerous that they would block the roads for all other transport.

There are three types of horse-drawn ambulance wagons—Mark V, Mark VI and Mark I Light Ambulance wagon. The Mark V and Mark VI types are very much alike. They are large heavy vehicles which carry four patients on stretchers or twelve patients sitting, or two on strechers and four sitting. Lockers for medical stores, medical comforts, etc., are placed below the driver's seat and at the front end of the interior. Fittings are also provided to carry thigh splints above the front lockers. A water tank is secured under the rear of the vehicle. The wagon is fitted with bale hoops and a canvas cover.

The Mark I light ambulance car is much smaller and lighter than the previous types. It is intended for rapid movement and for work with the cavalry. It is constructed to carry two patients on stretchers or eight sitting, six inside and two outside.

Horse-drawn general service wagons are occasionally used to carry lightly wounded men, but this is more of the nature of a "lift" than a recognized and routine method of transport.

Horses or mules are frequently harnessed to the trolleys on the 1-meter gauge trench tramway carrying patients.

6. BY MECHANICAL TRANSPORT

Motor transport provides the best means of transportation of wounded from the front to the hospitals behind the line. It is speedy and comfortable. With relays of drivers the cars can be worked continuously in periods of stress. At night they can proceed close up to the line.

In each field ambulance there are seven ambulance cars; of these five or six are heavy cars and one or two are light cars. The heavy cars are of the English type. Owing to the broken-up state of the roads in the forward area slow driving is necessary, but if the ambulance car is

heavy and well sprung the journey is not uncomfortable for stretcher patients. Each unloaded car carries as equipment four stretchers folded up, eight blankets in summer and twelve in winter. In addition, in some armies a Thomas splint and suspension bar are carried in each car. The heavy type of ambulance car has accommodation for four stretcher patients, or two stretcher patients and four sitting, or eight sitting. The cars are heated by passing the exhaust gases in pipes around the interior of the car. A splinter-proof car for the better protection of the occupants has been used in France. The hood is covered with a strong wire network which extends down in front and at the sides of the driver. It causes a great increase in the weight of the car and is no real protection against anything but the smallest splinters.

The motor ambulance convoy is a unit consisting of 50 ambulance cars. It is made up of three sections, each self-contained, of which any one can be detached for duty. In addition to the personnel of drivers and orderlies, there is a mobile workshop mounted on a truck with a staff of mechanics who can effect all ordinary repairs.

Motor trucks, omnibuses and char-a-bancs are used during active operations to convey the lightly wounded from the "walking wounded post" to the evacuation hospital. A number of these vehicles are allotted to the medical services at these times. When 3-ton trucks are used, seats are fitted round the sides and small ladders are constructed to assist in loading. Each truck will carry twenty men. Motor omnibuses and char-a-bancs are more comfortable as seats are already fitted. All vehicles temporarily used for the carriage of wounded have a distinguishing Red Cross flag exposed prominently in front so that the traffic-regulating guards may recognize them and give them right of way on the roads. Motor bicycles with a side-car attachment to carry a single stretcher are used by the French Army, but are not in use on the British front.

7. BY RAILWAY TRANSPORT

Ambulance trains are divided into three categories: (*a*) Permanent ambulance trains, (*b*) temporary ambulance trains, (*c*) improvised ambulance trains.

Permanent ambulance trains, or, as they are often called, "hospital trains," are specially built and equipped for the purpose of transporting serious cases. They consist of special ambulance coaches fitted with tiers of cots, coaches for sitting cases, dispensary, pack store, kitchens, operating theater and coaches for personnel and supplies. There is corridor communication throughout. The coaches for the sick are so constructed that wounded can be loaded and unloaded with ease. Each hospital train has a permanent staff.

Temporary hospital trains are made up of the ordinary vans or coaches equipped with some arrangement for carrying sick and wounded. There are various specially devised fittings for this purpose. The Bréchot-Desprez-Ameline apparatus consists of an iron framework which carries three stretchers on springs in tiers. Four of these can be carried in a French van of the closed type. They are fixed in the corners of the van. If necessary, a fifth can be placed transversely in the center. This gives accommodation for 12 or 15 stretcher cases in each van.

In the Zavodovski method the stretchers are suspended from cables which stretch across the van and are anchored by ropes to rings in the floor of the vehicle. By this method 8 or 10 stretchers can be carried.

Improvised hospital trains are composed of vehicles which have brought up stores, etc., to the front and are utilized on the return journey to take back wounded. The Decauville light railway system, which is largely used for carrying heavy ammunition from the railhead to the guns, has been of valuable assistance in evacuating wounded from the advanced dressing stations. Each truck carries two stretchers, the handles of which rest in grooves in the ends of the truck. No extra fittings are required.

8. BY WATER TRANSPORT

Water transport is well adapted for the removal of serious cases, and when canals and waterways exist on the western front they have been used to convey wounded from the evacuation hospitals to the base hospitals. The wounded are carried in barges which are specially fitted for the purpose. Each barge carries 30 patients, who are lowered into it by means of a central elevator worked by hand. The barges are towed in convoys of three by a steam tug. This form of transport is utilized chiefly for patients with serious head, chest or abdominal wounds. Pontoons have been used to bring back wounded from the forward area to the advanced dressing stations. During the Arras battle pontoons were used on the river Scarpe for this purpose. They were towed by R. A. M. C. bearers.

HOSPITAL SHIPS

These are specially fitted ships for the transport of wounded overseas. The ships are painted white with a broad green band running from stem to stern. Red crosses are painted on the sides of the ship and on the funnel. At night the ship is illuminated by green lights round the hull, and the red cross is formed by red electric lamps. The marks of a hospital ship are so distinctive that it would be impossible to mistake it for anything else. Ships of all sizes and carrying capacity have been used. The smallest accommodates 200 and the largest 3,000. Returning transports are sometimes used to bring back wounded, but unless there is wide and open deck space they are unsatisfactory.

THE ARMY VENEREAL PROBLEM

By Major G. R. CALLENDER
Medical Corps, U. S. Army

EFFICIENCY may safely be considered as the watchword of the modern era. Let us consider the factors which have been shown to lead to that much desired goal.

The great business organizations in this and other countries have progressed toward this goal in a remarkable degree. The steps in this progress show the adoption of labor-saving devices too numerous to mention, consolidation with diminution of overhead expenses and coördination of interests, etc., until, at present, little is to be desired in these directions; but still there remains much to be accomplished. Gradually people have come to the conclusion that individual personal efficiency is the next, if not the final, step in this advance.

The personal factor, as might be expected, resolves itself into three others; that of morals, of intellect, and of health on which the intellect so largely depends. It is human to err and civilization is prone to indulge to a greater or lesser degree in vice. Though that tendency is markedly inhibited by the churches and allied organizations, nevertheless, there are many who, realizing the moral right and wrong, will not or do not interpret their convictions by actions, and many more who do not consider such at all, because they fail to connect these influences with their material welfare, with which alone they are apparently concerned. There is practically none, however, to whom pain and sickness are strangers, even though he does not always realize the etiological factors. Morality is the goal to which some may attain at once, but the majority will proceed slowly along through intervening phases of advance.

The drug and alcohol addictions have long been recognized as vital influences in promoting inefficiency, and one needs but to note the strides towards temperance during the past two years to realize that abstinence is to be a prominent step in the campaign for efficiency.

Most of the various infectious diseases, because of their ability to spread and involve large numbers of people, have always been fought with all possible zeal, and the fight has been aided by many laws and restrictions, yet the most formidable of these—venereal diseases, which cause more pain, misery and deaths than all others, if the truth be told, and consequently contribute a maximum toward

inefficiency, go on their way unrestricted and, in fact, nourished, by the almost total lack of publicity they receive and the constant absence of knowledge the public has of their ravages.

Some day, in the movement for efficiency, these facts will be brought out in their true light and to do this, in a small way, is the object of this paper.

Venereal diseases have been and are one of the greatest scourges of all armies, yet how little is heard of them outside our immediate circle, in comparison with what is heard of typhoid, yellow fever and infantile paralysis. Is it right that these diseases, undoubtedly of far greater importance to the well-being and betterment of our race, should be kept constantly in the dark and allowed to go on unrestrictedly, involving greater and greater numbers of our population with never a voice rising above a subdued whisper to say nay? Military medical officers are perfectly aware of the conditions and dangers but, as their efforts are necessarily confined to the limits of their garrison, they can accomplish little toward the eradication or diminution of these diseases in general, and no one outside the services aids in any but a limited degree.

Military service requires physical fitness as nearly as possible approaching perfection, and to accomplish this in each and every soldier is the prime duty of the medical officer. In his struggle to this end he has been confronted with many diseases, but none have so completely baffled him as venereal diseases. Yellow fever, smallpox, typhoid and many others have all succumbed to untiring effort, largely because the means of control have been placed in the hands of the military surgeon, and military law has enforced their use unhampered by interference of civil authorities, be it said, because the measures used have not interfered with the ideas of the communities within which they were used, nor even remotely affected the sacred personal liberty of the civilian. It is not so with venereal diseases. The Army and Navy have made and enforced laws governing the prophylaxis and treatment of venereal diseases among their members; but only in exceptional instances and for brief periods during military occupation of certain places, outside the continental United States, have they been able in any way to control the sources of infection.

The published reports of the morbidity from venereal diseases in armies show that of the United States to be among the highest; yet in no other army are greater efforts made to recognize venereal diseases or accurate records kept of their occurrence. Routine physical inspections result in the detection of many cases, either at the inspec-

tion or before, by voluntary admission. The routine examination of urine and the liberal use of the Wassermann uncover a large percentage of the existing diseases, while the recent adoption of the latter test at recruit depots detects practically all the syphilitics entering the service. It is probable, however, that the incidence of these diseases the U. S. Army has been quite as great if not greater in recent years than in most, if not all of, the continental armies. As Howard says:

> The more general application of personal disinfection, following coitus, under official sanction and direction, and the more effective regulation and control of prostitution, are the factors probably responsible for the lesser incidence abroad.
>
> Venereal diseases in armies, while not entirely eradicable, are preventable in great part. The specific causes, the exact methods of transmission, and the sources of infection are known, hence the accepted principles of scientific preventive medicine should be applied for their control as far as possible.
>
> Prophylactic measures of known efficacy may be possible of application in some armies and not in others. The problem is therefore a special one for each army concerned. In the United States Army, whatever effective measures we are able to apply are those directed chiefly to the individual soldier. The sources of infection are beyond military control, and we can hope for no effective regulation and sanitary supervision of prostitution by the civil authorities in view of a public sentiment in the United States unalterably opposed to any form of official recognition. The policy of the higher military authorities in the War Department for many years was one of silence and inaction concerning the question. The issuance of military orders directing inspections of troops for venereal diseases, the use of prophylactic solutions following intercourse, or other preventive measures, were opposed, as it was held that the publication of such orders may prove offensive to the general public and humiliating to the service.
>
> The subjects of sexual hygiene, the venereal diseases, and the social evil are now discussed from public platforms and in the press with a frankness that would not have been tolerated by public sentiment a decade ago. The public is thus being enlightened concerning the wide prevalence and frightful ravages of venereal diseases. It is believed that the fuller discussion and comprehension of the venereal peril has been productive of much good and may ultimately result in the application of straightforward and sane measures for the control of these diseases in civil communities. Indirectly this will benefit the Army, for the soldier does not contract venereal disease in his barracks but from the prostitute in civil communities, who at present is permitted to disseminate infection without restriction.

Another factor of prime importance in the venereal problem is alcoholic indulgence. Colonel Maus, writing in 1912, said:

The educated world has begun to realize that the three great social cankers —alcoholic addiction, prostitution, and venereal diseases—must be met by scientific and rational measures. Why attempt longer to conceal in the closets of social life these ghastly skeletons which for centuries have been gradually but surely gnawing their way to the very heart of human existence? Venereal diseases are intimately associated with two of the most prominent sociological problems of the age, alcoholic addiction and prostitution, and assisted by the increasing immoral tendency will, if not checked, lead to a declining birth rate, degeneracy and possibly race annihilation. Alcohol plays such an important rôle in the contraction of venereal disease that it is questionable whether more than 5 per cent of the morbidity occurs among the abstaining class. The educated world is rapidly drifting to a high plane of rationalism in the discussion of these problems and beginning to discard maudlin sentiment and prudishness which, heretofore, have stood as barriers to intelligent action and common sense.

Speaking of the military control of prostitution in Jolo in the early days of the Philippine insurrection, Colonel Maus said:

At the time Jolo was under military control and the public women were examined weekly and segregated. Those found diseased were at once transferred to a lock hospital and retained until they were cured or the infectious stage had passed. The results were most gratifying among the troops, inasmuch as they were practically kept free from these loathsome diseases during the regime, which lasted several years.

In regard to the examinations he said: "The examinations should be made with great care and none countenanced unless made with the speculum and microscope."

Let us now consider the results of venereal diseases as indicated by our sick report.

In the decade ending December, 1912, there were for all venereal diseases 118,056 admissions, or 180 per thousand; 1,732 discharges, or 2.6 per thousand. The discharges were exceeded only by those for tuberculosis. In the year 1914, there were 9,655 admissions, or a ratio of 110; 67 discharges and 5 deaths. Venereal prophylaxis had been in use for five years, and the reduction from 180 to 110 is thus explained. In admissions, venereal diseases exceeded by over 70,000 their nearest competitor in the decade mentioned, and in the year 1914 exceeded by about 5,000 the next most frequent cause of admission, acute affections of the throat.

The noneffective rate for venereal diseases, the true measure of their result on military efficiency, was, for all troops in 1914, 434.6, or a ratio of 4.47—more than twice that of any other disease. This means, in plain terms, that there were in our army, averaging about 98,000 men, 434 constantly sick in hospital with venereal disease, or

about 8 men in every 2,000. In addition many were under treatment but not in hospital.

The sick report, while indicating very clearly the importance of venereal diseases, does not begin to portray their prevalence. Many cases are admitted several times but, what is more important, many cases of syphilis pass unrecognized.

Colonel Vedder, in a comprehensive series of Wassermann surveys, determined that about 16 per cent of our white enlisted personnel were syphilitic, while the colored troops about doubled that figure. Of these only about 3 per cent were recognized and carried on the registers as syphilitics.

When we consider that gonorrhea is about four times as prevalent as syphilis and that chancroid has an admission rate about equal to that of syphilis, the size and importance of the venereal problem begin to appeal to us.

To these figures of the active diseases, we must add some of the end results, of which some are really of greater importance individually. It is generally conceded that about 13 per cent of insanity is due to acquired syphilis, which means that about 10 or 11 cases are sent to the Government Hospital for the insane each year from the service for this cause. In many other conditions, particularly affections of the heart and blood vessels, a certain proportion, and sometimes a large one, are the results or a part of the syphilitic infection. It was found that the percentage of syphilitics at Fort Bayard was more than double that of the men in the service, thus indicating clearly that syphilitics are more prone to the ravages of tuberculosis, and it was generally accepted there, during my own tour of duty at that hospital, that curing the syphilis in a person also tuberculous, markedly increased his chances of recovery from the latter disease. I may state here that tuberculosis has the highest discharge rate of any disease in our army.

Is it possible that all this infection occurs during service? Yes, possible, but the facts are otherwise. The larger proportion of the cases of gonorrhea naturally originates during the soldier's stay in the Army, although a careful study to exclude recurrence antedating enlistment has not been made, and it indeed would be practically impossible. Except at recruit stations chancroid is incurred during the service of the soldier.

At Jefferson Barracks, a recruit depot in 1911, Colonel Howard determined that about 50 per cent of venereal infections occurring at that post were contracted prior to enlistment. This percentage would probably be exceeded at the present day, with the use on every recruit of the complement fixation test for syphilis.

Vedder in his study made surveys on recruits and determined that whereas in enlisted men 16 per cent were syphilitic, 20 per cent of recruits were affected, or, in other words, civilians of the class from which the army is recruited were afflicted with this disease to a greater degree. Comparison of these results indicates that after the recruit has joined, because of adequate treatment of the disease to a certain extent, and rather rapid separation of syphilitics from the service for other disabilities more or less dependent, the percentage of syphilis decreases to an appreciable degree.

In a similar survey on the cadets at West Point, Vedder estimates that about 5 per cent are syphilized before entrance into the service. This means that this percentage of our college population are afflicted, and probably more, as the cadets are picked men physically.

College men belong to those who form the great middle class of our country. It seems to me that a disease with a prevalence as shown by these surveys, linked with its confreres, chancroid with an equal incidence and gonorrhea with four times its incidence, or a total incidence in the latter class discussed of 30 per cent, demands more than an expression of disgust. It demands action of the most strenuous kind, and delay in dealing with this problem as one of disease, only increases its hold and the numbers hopelessly invalided through its means, to say nothing of its effect on the efficiency of our troops and industries.

Much more can now be told of the ravages of these diseases and still more will eventually be laid at their door, by the more accurate methods of diagnosis. I will mention in closing only a few conditions and their relation numerically to venereal diseases.

Miscarriages (fourth to seventh lunar month), if the child is born dead, 35 to 40 per cent is due to syphilis. Premature births at about 8 months are very frequently due to syphilis, about two-thirds of all syphilitic children being born at this time.

Only about 28 per cent of children born syphilitic survive the first year. The child of a syphilitic mother is almost always syphilitic.

A very large proportion of cases of arteriosclerosis in men under forty are due primarily to syphilis, while locomotor ataxia and paresis are now recognized as the terminations of many cases of syphilis.

Gonorrhea causes a very large proportion of chronic invalidism, particularly in women, and 50 to 75 per cent of abdominal operations in women are for conditions, the result of this disease. Most of those women are innocently infected by their husbands, who acquired their infection otherwise than innocently, and represent themselves to their better halves as paragons of virtue of which, alas, there are but few.

COMMENTS ON THE ARMY VENEREAL PROBLEM

By Colonel R. G. EBERT

Medical Corps, U. S. Army; Department Surgeon, etc.

THE data taken from sick and wounded reports of the Hawaiian Department, for the period January 1, 1915, to June 30, 1916, show that the total number of admissions for venereal diseases is 1,602, with a loss of 21,448 days as against a total admission for all other causes of 6,241 and 63,057 days lost. In other words, more than 20 per cent of all admissions and nearly 25 per cent of all time lost to the Government from disease and injury in Hawaii are due to venereal diseases. These totals are based on an average strength of 8,833. Comparing these rates with the army elsewhere it is found, for the three years 1913, 1914 and 1915, immediately preceding the above period, that Hawaii has practically the same figures as the mainland—97.32 per thousand for Hawaii, 97.13 for the United States proper, while the Army as a whole gives 114.83.

Of the new cases reported from January 1, 1915, to June 30, 1916, 147 syphilis, 139 chancroids, and 620 gonorrhea, total 906, all were contracted in these islands. Many of these appear in subsequent admissions among the total of 1,602, and so the last figures do not represent an actual number of individuals.

Syphilitic registers show at present 360 cases of this disease among enlisted men. Of these 123 were contracted prior to enlistment, 82 since enlistment and prior to joining in Hawaii, and 155 contracted here. The difference between 155 and 147, reported as contracted here, is due to men having departed from these islands and to new cases developing since July 1, 1916.

Of the registers now in force, 102 show a present status of double plus Wassermann reaction, and 45 a single plus; these may be called active cases. Sixty-seven show a plus-minus and 146 a minus reaction, and while the plus-minuses are not actually in abeyance, they show such improvement that they may enter a different classification from the active.

Surgeons have reported that practically all active cases are, in their opinion, discovered by the inspections; of the latent cases, possibly 80 to 85 per cent have escaped detection.

There is no such check on chancroidal or gonorrheal cases prior to entry into service as on syphilitic, and to approximate the total of all venereal diseases it is fair to assume that the ratio of incidence 16 plus,

15 plus, 68 plus, in the 906 cases which were contracted in Hawaii, will apply elsewhere. That this is not far wrong the Surgeon General's reports show, since the admissions for ten years (1901–1910) for syphilis, chancroids and gonorrhea, with their complications, were in the proportion of 15, 19 and 65 respectively. Applying the ratio, 1 syphilitic to 1 chancroidal and 4 gonorrheal, and having positive syphilitic records of 360 cases in the entire command, we have reason to assume that at least 2,160 individuals have had venereal diseases at some time. As probably only one-fifth of the latent cases of syphilis have been detected and made a matter of record, and considering only the 146 absolutely minus Wassermann cases as latent, we have reason to add to the 360 cases of syphilis recorded 584 additional, which at the former ratio (1 to 5 of incidence) would add 2,920 more venereal cases, or a total of approximately 5,000. These numbers are more than conservative. By Vedder's statement "that approximately 17 per cent of recruits are already syphilitic at the time they enter the service," allowing some margin—say 10 per cent—for congenital cases and those innocently acquired and applying the ratio of incidence, 5 cases of gonorrhea and chancroid to one of syphilis, we find that among each 100 civilians of the class from which recruits are obtained and of the average first enlistment age, 15 have contracted syphilis and 75 the other diseases. Making a further allowance of 10 per cent or even 20 per cent for multiple infection, we still have 72 to 81 out of 100 who have had venereal diseases prior to enlistment. These are startling figures.[1] In no way can they be attributed to army life, as they exist at the time of enlistment, and, as recruits are obtained from every section of the country, they may be said to represent nation-wide conditions among the class of young men that make up our enlisted forces.

In earlier days, long before venereal prophylaxis was inaugurated, when taking sick call and doing duty as ward surgeon, it was my custom to ask the source of infection, whether for "love" or "money," and the amount of damage done by non-professionals was far from inconsiderable. Advice given then to the men to form a protective association, and warn against the particular women who were spreading disease, had often a contrary result.

The policy of the ostrich—hiding the head and exposing the body—

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[1] In the September, 1916, number of *American Journal of Public Health*, page 953, at the head of an article "The Efficiency of Venereal Clinics," by Philip S. Platt, Superintendent Bureau of Public Health and Hygiene, New York Association for Improving the Condition of the Poor, the following appears: "One million, two hundred and fifty thousand individuals were treated in one hundred and twenty-two clinics in New York City in 1913 for venereal diseases . . . ." As New York's population in 1910 was 4,766,883, say 5,500,000 in 1913, it will be seen that about 22½ per cent of all men, women and children were treated in clinics. Allowing for duplications (one individual going to more than one clinic) the numbers would be reduced, but to this must be added the number of patients who are treated by private physicians, drug store prescriptions, and self-treatment.

immorality rampant, but not to be whispered above the breath, was in full vogue and such instruction as was given was delivered to the individual in private.

Average yearly admission rates for all classes of venereal diseases in the Army from 1872 to 1911, by half-decade periods, are as follows:

1872 to 1876	105.6
1877 to 1881	97.2
1882 to 1886	76.4
1887 to 1891	77.2
1892 to 1896	76.4
1897 to 1901	121.8
1902 to 1906	149.2
1907 to 1911	147.6

From the foregoing figures it will be observed there was an apparent vast increase with the Spanish-American War. This was partly due to the influx of recruits and the generally new conditions surrounding the Army, and partly to the fact that, prior to 1900, practically all admissions to sick report for venereal diseases were based on men actually incapacitated. No physical inspections were then made, and many cases were concealed and self-treated; others were prescribed for but not recorded, except when disability became so great as to preclude duty by the patient. Moreover, many venereal complications were not recognized as such and were carried under other headings, owing to our knowledge being imperfect. This is well illustrated by the carrying over, from old Manuals of the Medical Department to the present, of the provisions of paragraph 456 (*m*) "Distinction should be made between the venereal ulcer known as chancroid and the hard chancre of primary syphilis."

From these figures it is evident there is no subject in preventive medicine of greater importance to the Army than that of venereal diseases, and that if civil authority should take this matter properly in hand with the man prior to enlistment, our duties would be much lightened; for it is more than probable that 72 to 81 per cent of our soldiers suffered from venereal diseases before joining. The tale that army life tends to debauch youth is false. Taking the average age of enlistment as at twenty-two, in the five or six years immediately preceding this age, 72 to 81 per cent of the men had had venereal disease, or at a rate of 12 to 16 per year. Our figures in Hawaii show that out of 8,833, in a year and a half, there were contracted 906 new cases, or to the extent of 6.83 per cent per year, one-half of the rate contracted prior to entry. Let us take this one step further; if 72 to 81 per cent have had venereal disease of some kind prior to the average age of twenty-two, what percentage have had sexual intercourse? Certainly more than the 72 or 81, for not everyone who transgressed became diseased.

Prudery in the past has prevented free discussion of the sex problem; one may talk of tuberculosis or smallpox or leprosy in the parlor or public assembly, but gonococcus infection and lues are subjects tabooed. Certain classes throw up their hands in horror at the idea of venereal prophylaxis, denouncing it as an inducement to illicit intercourse and legitimizing prostitution by rendering it safe, instead of, as we contend, giving a protection to the individual and to the race. For years, because of this clamor, the military authorities hesitated to openly instruct and practice that which would save numerous days of sickness, with attendant expense to the Government, and to many individuals, suffering, permanent disability, insanity, and life, leaving wholly out of the question service efficiency. That the sanitarians' claim is correct, the following data of venereal incidence, taken from official reports of Hawaiian posts, are presented:

Year	*Admissions per M.*	*Non-effective rate*	*Total strength*
1905	153.39	13.01	176
1906	224.14	18.02	248
1907	223.96	12.84	192
1908	239.22	12.59	281
1909	225.84	23.23	1,087
1910	159.02	21.89	1,225
1911	175.27	15.78	2,014
1912	122.93	8.69	3,376
1913	91.68	5.04	6,130
1914	65.07	3.41	8,293
1915	119.55	4.43	8,958
1916	60.00*	4.44	8,594

The year 1909 marked the beginning of the prophylaxis agitation and its results are not seen until the following period. In August, 1912, the present orders as to punishment for failure to use prophlaxis were published, and the results in subsequent years are shown far more markedly in the rate of constant non-effectives (which is more nearly the true criterion) than in admissions. The year 1915 was one in which 3,500 to 4,000 recruits joined, and much of the increase in admissions may have been due to the recording of old cases of venereals, but new to *our* hospitals, and to the lack of obedience to orders by young soldiers. Data for 1916 are for the half-year; the rate is as high as 1915 and appears due to laxity in carrying out orders by the commands, and to greater activity on the part of the medical department in the treatment of syphilitics, all of which cases are made of record. If Hawaii data need corroboration, the figures for the army at large are available, with which I will not now take up space.

No one desires more than the army sanitarian that all illicit sexual intercourse be absolutely suppressed, as in that way only can venereal

diseases be overcome; but never in the history of the world has this been accomplished. The Power that framed the human animal gave, to some of them at least, characteristics that preclude that desired result; and where shall we throw the blame? All men cannot be made moral by law; some may be repressed by fear of law, but these will not hesitate to disregard the edict, if a safe opportunity offers. The first duty is to instruct the individual in the full knowledge of the sexual relationship; tone up his moral fiber and teach him to appreciate that the various codes of ethics—religious, moral and legal—are the results of the best experience of the races that promulgated them. If reasoning does not appeal and fear too fails, as it does in so many instances, is then the medical officer wrong when he endeavors to protect the Government, the man, and the community, present and future, by lessening the chances of incidence and rendering as innocuous as possible the diseases liable to be incurred?

There are two ways of accomplishing this protection; one is the segregation of all who are infections (and I do not mean the female alone); the other is the use of such prophylaxis as experience has shown to be valuable. We have orders for the semi-monthly inspection of the soldier, for the immediate use of prophylaxis after exposure and for segregation when diseased. Over the female we have no restraint. Where control of the women has been had—as in the British-Indian army prior to the nineties—although venereal diseases were not eradicated (for men would forage out of bounds), the results were good as compared to what happened after the system was abandoned at the behest of well-intentioned but impractical public opinion in England. Syphilis, which was present to a limited extent under the cantonment system, became so rampant that over 80 per cent of all white troops in India were luetic, and cases so graphically pictured by Kipling were far from rare. The medical journals of the time fully discussed the subject, and dwelt with alarm upon the probable effects upon the British nation when these men returned to the mother country and became possible heads of families.

Under present orders, the soldier discovered with venereal disease in an infectious stage is held in hospital or otherwise isolated. His disease is made a matter of official record, for the protection of the Government and of his comrades. Could the same be done with the civilian, venereal diseases would be reduced to a minimum. While frequent inspection of prostitutes is no assurance of safety, since a woman pronounced free one day may easily become the active disseminator of disease the next, yet an examination will eliminate her quite a period earlier than otherwise, and that period means at least

five or six contacts saved daily from possible infection. It is not the gain of an entire loaf by a good deal, but still some bread; why, then, reject any help is so important a sanitary matter?

We no more legalize prostitution by rendering it less dangerous than we legalize the pollution of a stream by instituting a filtration plant for its waters. Let us treat both in the same common-sense manner. No sanitary engineer would scatter polluted water broadcast over a community and then attempt its purification. He would bring it into one plant and purify it under constant and direct supervision.

Why not apply the principle of isolation that Hawaii has adopted with its lepers, a disease far less easily communicated and of no worse consequences; and then, like the lepers, when the afflicted are cured and no longer a menace to the community, restore them to society. Leprosy has not been eradicated by this process, but does anyone doubt that it has lessened its prevalence? Why not apply the same principle to diseases a hundred-fold more prevalent than leprosy? Why make diphtheria, smallpox, measles, scarlet fever and leprosy, from which Honolulu had in the past three years (1913–1915) 51 deaths, notifiable and quarantinable diseases, and remain silent regarding venereal diseases, when from syphilis and its results alone 62 deaths are reported under the heads of syphilis acquired, syphilis congenital, locomotor ataxia and paralysis of insane? Of how important a factor it must have been in the cases of death of 272 still births, 83 apoplexies, 41 arterioscleroses, 19 hemiplegias and 28 paralyses, every physician can form his own opinion. What, think you, would be the result if the law required that every case of venereal infectious disease was made a matter of official record, as it is in the Army? And is there a single reason, other than that of the exposure of human frailty, for not doing so? Truly since venereal diseases are so great a curse (the greatest of curses—the visiting of the sins of the fathers and mothers on the innocent children), can intelligent people consider that reason sound or anything but a cloak for immorality?

To those who would eradicate the social evil, let me suggest the method of publication and quarantine. All others, license, regulation, segregation, dispersion, suppression, silence, prosecution and persecution, even the marking of the woman as in the romantic story of Hawthorne's "Scarlet Letter," have been tried and failed.

Publication of those who are infectious will not entirely do away with illicit intercourse, but when such are posted we are in the right way of lessening at least the physical evils. The other features of this world old problem, we, as sanitarians and medical officers, must leave to the professional moralists.

MEDICO-MILITARY NOTES

By Major R. W. HINDS

Medical Corps, N. A. (formerly with the American Red Cross)

I HAD the good fortune to serve under the American Red Cross as director, for one year as follows: Director of Unit D in England at the Haslar Royal Hospital, Gosport; later at Paignton, Devonshire, at the American Women's War Hospital; director of a unit for Belgium at La Panne with the Ambulance DePage. The following is the substance of a report made upon my return home.

Many topics are merely touched upon, and few are treated fully for the reason that I was not in a position to pursue each topic to a conclusion. In Belgium, which is known to be a nest of spies, everyone is under suspicion and questions are not encouraged. My work was in hospitals, and it was not easy to obtain permission to travel and look into things much as I would have liked to do so. The distribution of all the sick and wounded of the British Navy is arranged from the Director General's office. Here a list of hospitals, with the capacity of each, is posted daily so as to show the number of patients under treatment and the number of vacant beds. An incoming hospital ship sends a wireless giving the number of wounded and the point of debarkation. The Director General in return assigns the cases to available hospitals, and arranges so that hospital trains may be in readiness upon the arrival of the ship, the railways clear from the port to the indicated hospital, and the hospitals prepared for the reception of the wounded.

It is not desirable to assign patients in lots of less than one hundred to a hospital. To facilitate transportation, a hospital train on one route should be able to unload without breaking up on branch lines. Therefore a hospital on a spur track would be undesirable, unless it could accommodate nearly two hundred. Such a hospital, after the discharge of 30 per cent of convalescents, could accommodate a second trainload. Larger hospitals tend, of course, to a steadier flow of patient's small ones to periods of comparative idleness, alternating with overwork.

Haslar Royal Naval Hospital at Gosport, capacity of about 1,700 beds, is an example of a permanent base hospital, fully equipped and used to a considerable extent as a training school for volunteer surgeons, sick bay stewards, orderlies and St. John's Ambulance Co. (the latter

being trained to act as orderlies). Here the work was very well done and the discipline most excellent. It was divided into medical, surgical, infectious and genito-urinary services, a staff surgeon in charge of each with subordinate surgeons. There were two salaried consultants from civil life, both eminent men. Everything ran smoothly because the responsible positions were held by regular naval men. There were few specialists as the naval surgeons pride themselves on being able to do the ordinary operations of nose, throat, eye, etc.

Temporary base hospitals, for the duration of war only, were established by the British Red Cross or similiar organizations. Many of the smaller were paid for by private individuals. As the war progressed most of the latter accepted help from the government at a fixed rate per patient per day. The smaller institutions were painlessly put to death. They were nearly all started at a time when it seemed that the war was to be of short duration. Throughout France and Belgium the privately maintained hospitals seemed to have excellent equipment, often better than the regular organizations.

In temporary hospitals an astonishing number of civilian helpers offer their services, and some of them do surprisingly good work for long periods. For example, a New York broker worked for a year, receiving his room and board part of the time only. He developed into a very capable X-ray man with no previous experience.

A separate hospital of more than three hundred beds should have some sort of a separate building for infectious cases. Smaller institutions can get along by transferring patients of this kind as they occur.

In England, small convalescent hospitals taking cases that required only an occasion medical visit were allowed to continue. Private homes took many. This type of hospital relieved the bases of a lot of occupied beds. For base hospitals, large buildings were utilized or portable houses put up (portable in comparative sense only, frame with corrugated iron roof or in sections, walls, ends, etc.). In the utilization of dwellings built for other purposes certain changes have to be made, notably arrangements for lavatories and ward kitchens, both requiring a lot of piping. This problem was solved in brilliant fashion at Paignton by constructing small wings the full height of the building, and changing windows between, on each floor, into doors. This saved much trouble with the piping, which ran from top to bottom, entirely within the additions. Verandas may be closed in and used as ward kitchens, thus saving the danger from fires, and keeping the odors of cooking out of the wards. The other changes were minor, such as cutting doors, waterproofing floor of operating room, etc.

There was a growing tendency to organize hospitals for specialties

such as eye, nerve, medical cases. The genito-urinary cases generally go to the regularly established military hospital. The administration of this type is difficult, as the whole staff is new and the duties ill defined. An active or retired army medical officer is indispensable for the management of the military records of enlisted men. His work is not medical, but the control of the individual and his equipment, care of correspondence with headquarters, publishing orders received, returns, etc. (another argument for fewer and larger institutions, as such men are scarce). In such cases he has nothing to do with the treatment or medical records of cases except at time of discharge.

RECORDS OF CASE HISTORIES

Case histories were filed numerically and an index was arranged alphabetically. Cross indexes were arranged according to the following classification.

I. *Type of Injury.*—(*A*) Wounds—(1) Perforating: (*a*) shrapnel, (*b*) shell, (*c*) gunshot. (2) Non-perforating: (*a*) shrapnel, (*b*) gunshot, (*c*) shell, (*d*) grenade. (3) Incised. (*B*) Miscellaneous Injuries—burn, crush, dislocation, etc.

II. *Complications.*—(*A*) Infections—(*a*) neuritis, (*b*) retained foreign bodies, (*c*) fractures (anatomical arrangement).

III. *Location of Injuries* (with the exception of fractures).

IV. *Non-traumatic Surgical Conditions.*

V. *Operations.*—(*A*) Before admission. (*B*) After admission.

VI. *Medical Conditions.*—(*A*) Infectious: dysentery, typhoid, etc. (*B*) Non-infectious. (*C*) Eye. (*D*) Skin. (*E*) G. U. system. (*F*) Miscellaneous.

VII. *Results of Treatment.*—(*A*) Cured, improved, unimproved, dead.

VIII. *Time Elapsed from Injury to First Aid.*

IX. *Time from Duty.*—(*A*) In this hospital. (*B*) In other hospitals.

X. *Disposition.*—(*A*) Duty. (*B*) Invalided out of service. (*C*) Transferred.

To complete the record the number of each case was entered upon an appropriate card of each classification. If it were desired to look up retained foreign bodies of the chest, III gives all the chest cases and a reference to I (*A*) 2 would show just what cases are desired.

The system seems cumbersome, but if my memory serves me correctly, five of us were able to classify two hundred cases in less than three hours.

Iron beds should be high and strongly made. Cheap beds break at the joint between the side pieces and the ends. By each bed should

be a locker, cradle, bed tray (legs about 5 inches long); back rests and dressing cars in each ward, as well as opaque curtains for all apertures, if in the zone of aeroplane attack.

At Haslar, the diets were: milk, low and full. All but the last could be supplemented. The exception made saved 90 per cent of the complications in the kitchen, since that proportion took the full diet. The full diet was made particulary generous with this object in view, *i. e.*, to save a lot of extra individual orders. I have a diet sheet of this hospital showing weights of foods. At Paignton and La Panne the food cost per patient was very low, due to the patriotic contributions of staples. In the former place the fishermen of Brixham contributed the pick of their catch every Thursday and never failed to provide enough.

Fracture appliances are usually stored at points available to the wards. Plaster of Paris bandages are best freshly made from ordinary bandage and the best plaster obtainable.

Dr. De Page has a very efficient way of using plaster of Paris for compound fractures. A single or double compound femur is put up in a double spica, with three braces connecting the legs. For these braces he uses coarse metal gauze like that found in a hospital corps pouch, cut 20 by 2½ inches. At the site of the dressings he bends the strips and places two on each side, one anterior and one external, winding them heavily with plaster bandage. When hardened, these serve as handles in moving the patient, give rigidity, and no plaster is near enough to the wound to become foul. Compound fractures of both bones of the forearm or humerus are treated in the same way. Once the plaster is set the patients will stand a lot of shaking without complaint. A particular advantage lay in the fact that they could be moved in case of bombardment.

At La Panne a small autoclave did the work for the operating room and wards, at a time when the hospital had about 300 beds. It had to run day and night to do it. Everything was sterilized in drums. Later a larger autoclave was provided.

X-ray and fluoroscope are indispensable, but not infallible in old, partially healed wounds. A powerful X-ray apparatus on wheels was very useful in the wards. The telephone probe is a cheap and interesting toy, but is rarely of use. The electro-vibreur is said to be very useful. It is easily made, costing but $50 for the materials. Its action depends upon an alternating current, and works with iron, steel and nickel fragments. There is said to be enough iron in German aluminum fuses so that the particles may be located with it. I should say that its use would be principally in partially healed wounds at base

hospitals, since fresh wounds permit careful exploration during the cleansing process.

As to the magnet so useful in eye work, I understand it is of little value except where the bit of metal is in a fluid or semifluid media, otherwise the metal cannot approach the magnet, and if the magnet can be brought into actual contact with the metal we can do the same with the finger and the apparatus is unnecessary.

If patients arrive by trainload lots, two or three hours' notice is necessary. Ambulances and bearers must be at the station. At the hospital some sort of ticket system must exist to aid in the distribution of patients to the vacant beds in the various wards. The stretcher cases always require the most care and should be evenly distributed to the wards on the lower floors, the latter as a fire precaution and to save litter work on stairways. Two blankets should be provided for each litter. At La Panne fully clothed men, with overcoats and one blanket, came in blue and shivering from the cold. At Paignton the stretchers went to the wards with the patients. It was always difficult to get them back to the station for the second or third time. It was out of the question to hold each ambulance till its litters came back from the wards, for this would have caused endless delay at the station.

In the wards dust sheets cover the beds to be occupied. Large bags, each with a tag, are provided for clothing, which must be sterilized. A careful search of pockets should be made for cartridges. The patient should be bathed, fed and put to bed. Only the more urgent cases have their wounds dressed at this time.

At the risk of some confusion I have not described the Ambulance DePage at La Panne with any sequence, for the following reason. It was a base hospital in the sense that the patients were sent to the rear so nearly cured that they required little more than a daily dressing, and almost no surgery. When, however, an engagement was expected, the hospital was emptied as well as possible, without risk to life and it became something resembling an evacuation hospital. During a battle, from its nearness to the front, it was in effect a field hospital, when the proposition was very different. The cases arrived at night in great numbers, often with no warning.

It may contribute to a better understanding of the Ambulance De Page to say that the enemy could easily bombard it with 6-inch guns—as they did Furnes, three miles farther south. Dunkirk and Calais had many damaging air raids, the latter by Zeppelins, while we, in three months, experienced but two air raids. Our buildings were a converted hotel (inflammable), four lightly constructed, but permanent, wooden wards with corrugated iron roofs and a number of brick villas for the

staff. The hospital was on the beach in a long row of villas, the town extending inland. The rest of the village in our row and the town were occupied by troops, in numbers varying from 2,000 to 8,000. You may be sure that red crosses were painted on the roofs of all of our large buildings. We remained only on account of the forbearance of the enemy.

At La Panne some sort of operation was the rule, and as it was undesirable to bring a dirty patient directly into the operating room, a system was devised by which the cases came to a pavilion containing a ward of 40 beds, baths, X-rays, a small operating room, rooms for doctors, nurses and orderlies. When a patient entered at night he was stripped, bathed, given anti-tetanic serum, X-rayed and taken to the small operating room. Here the wound was shaved and explored. If extensive or dirty, a complete operation was performed. If slight and very clean, the skin edges were pared without an anesthetic. Cases involving the brain, abdomen or chest were taken to a fully equipped night operating room instead of the small operating room. The following morning, cases from the admitting pavilion were transferred to the various wards. Cases admitted during the day, after the same preliminary measures, were sent at once to the various operating rooms in connection with the ward, since the whole staff were available. At night the doctors took their turn in the admitting pavilion—one up, and three on call nearby. It was one student's duty to see that all received the anti-tetanic serum. I scarcely saw any tetanus, although there was some at first. The man on duty at night also covered the emergency calls from the wards—often hemorrhage.

For about 800 beds there were four operating rooms with a total of nine tables, more could be improvised if there were many admissions. These were fairly busy even in slack periods, as the more serious daily dressings were performed there, this for two reasons: (1) It facilitated the ward work which was very heavy, and (2) it enabled the chief surgeons to keep track of the more grave cases. After a big engagement the whole staff worked continuously.

For the amusement of the soldier patients, vaudeville entertainments are encouraged, and in some places convalescents can be taken out motoring. Occasionally a convalescent patient would manage to get intoxicated, but the European soldier requires little discipline and behaves himself to an incredible extent, though I have heard several say, with great emphasis, that as soon as they got on furlough they were going to get deaf-dumb-paralytic drunk. For minor infringements of discipline, the usual one or two weeks' furlough would be curtailed. For a serious breach, the patient would be sent to a regular army hospital or court-martialed.

Both the British and Belgian soldiers have a tendency to take whatever is coming without complaint. They are thoroughly broken and make ideal patients. I tried to get the British regulars to complain of the food at the front, but they would not. These men coming from France after having been for days under a heavy shell fire were in an interesting nervous state. For the first few nights the wards would be constantly disturbed by men crying out. It took nearly a week for the men to realize that they were not under fire, and to get them so that they were not having nightmares.

I recollect but two men who wanted to go back for more. The rest did not complain and felt that continued service was inevitable. A man who has been through hell once and escaped with his life does not want any more of it. Of the two who wanted more, one was abnormal in many ways; the other operated a machine gun and enjoyed it. Quite a number went back from motives of revenge. With less disciplined men desertion would be much more common.

Most of the hospitals near the front had to improvise at one time or another. For example, cotton batting—that noncapillary, non-absorbent curse—gave out. Pieces of Turkish toweling were used instead and washed to be used again. It was absorbent, less bulky, and the staff liked it. A tremendous amount of some such material is needed. Economy of supplies such as is shown by all our larger hospitals, necessarily cannot be practiced at the front.

A Belgian regiment is said to have 250 men to a company, four companies to a battalion and four battalions to a regiment. Each company in the trenches has assigned it a sanitary corps man and two stretcher-bearers. Nothing remains sterile in the trenches, so they have almost no equipment. For the transportation of stretcher cases, wheel carts are very useful. In a number of instances two patients have been carried for short distances on one litter, lying opposite ways. The cases were taken to the second line of trenches at night, and from that point by zigzag communicating trenches to the battalion dressing station, in a dugout as nearly bomb-proof as possible. Here there were two doctors and four to six helpers. At this point hemorrhage is arrested, and iodine and sterile dressings applied. This station is near a road and must have a telephone. In this zone hospital corps men (Brancardiers) bury the dead and keep a record of them. In the trenches they do what they can with the enemy dead—bury them, or, if they cannot be reached, squirt gasoline on them and set fire to it, or use lime, etc. A strong odor from the dead bodies between the opposing trenches, borne by very light breeze, is taken to indicate an impending gas attack, since such air conditions are essential for an effective use of gas.

The distance that stretchers must be carried or wheeled is said to be 2,100 meters on an average. Each division dressing station collects cases from battalion dressing stations by ambulance, a distance by road of not more than 5½ miles. The actual distance of the division dressing station from the German trenches is estimated at 3½ miles. At the division dressing station slight cases are cared for; the more severe cases have their dressing renewed and are distributed at once to the larger hospitals. One division dressing station was in an old school building and accommodated 60 to 80 patients, mostly on straw ticks. One of its functions was to provide dispensary treatment for troops in the vicinity (reserves), and the separation of the sick into classes as follows: those who would be fit for duty in two to five days were kept at the division dressing station; their clothing was fumigated with sulphur to destroy vermin and baths were provided for the men by means of a portable water heater, fitted with a pipe which had eight spraying nozzles. In this manner eight men could bathe at a time, in little booths four on each side. Patients requiring two to three weeks' treatment were sent to another hospital that I will describe.

This hospital, in the same zone, received mostly medical cases, dysentery, bronchitis, etc; although hernia and hemorrhoid cases were operated upon and sent to their organizations after their recovery, never getting out of the fighting zone. Here they had another plant for bathing men, and killing vermin on clothes. One building contained headquarters and record room, a sitting room for officers and a dining room, another building had kitchen, men's quarters and, on the end nearest the road, a very small G. U. room. The last was for the treatment of outpatients who could come and go without being seen at night, if desired. They gave salvarsan and kept the patient overnight on a mattress. Other buildings about the same size were as follows: an operating and X-ray building, several wards accommodating about 30, with two rooms on each end; the first two rooms were for a doctor and a chief steward (the doctor was constantly responsible for the discipline and care of his ward), and the last two rooms for isolation. All these were new frame buildings, white enameled inside, and of the semi-portable type, with central ridge ventilation. There were stoves for heating, latrines like ours, and the buildings were scrupulously clean. A bomb-proof was nearby, guards were posted about the hospital.

A motor ambulance station, with about 50 cars, was located near the division dressing station and connected with it by telephone. The cars were used in carrying the wounded from the division dressing station to the rear.

Malingerers were eliminated at the division dressing station. They

sandpaper their shins, smoke cigarettes containing a pinch of salt with the tobacco—said to produce a frightful facies—and rupture the ear-drum by filling the external auditory meatus with water, and getting a friend to give them a box on the ear (in a lateral position, of course). This invariably produces a complete rupture of the drum. The rupture passing through the tip of the malleolus.

Many claim disabilities of hand or foot. To aid in their detection a small portable X-ray outfit is used. This consisted of a small one-cylinder gasoline engine, water-cooled by means of a circulation from a barrel on a chair to another on the floor, a small dynamo, a coil and a tube. The plates were as small as possible, 4 or 5 inches square, used for the metacarpal bones of an alleged injured hand. The table for X-ray work was a mere frame with removable wooden slats, home made. All of this could be easily loaded on one wagon. Eye and ear dark rooms were made by pinning up blankets in corners. The commanding officer said that he could move the whole plant in twenty minutes. Twenty or 30 horse-drawn ambulances were detailed to bring cases from the battalion dressing stations.

The country is open and very flat, nevertheless, horse-drawn ambulances are indispensable where there are no roads. In addition to the ambulances there was a little closed carriage for the priest, an X-ray wagon, a cook wagon, and several low wagons peculiar, as far as I know, to the Belgians. Each of the latter carried medical chests below and on stretchers above, ten stretchers on each side. This allowed room for the front wheels to undercut. These wagons were placed at 20-foot intervals on the periphery of a field where there were a few trees, to make their discovery and destruction by aircraft difficult.

English R. R. hospital trains have two marked advantages over ours, one in being able to unload at platforms that are flush with car floors, and the other in having side entrances to the cars. An interesting device to aid in unloading was a canvas strip (about 2 feet by 4 inches) with rings at the end. One of the canvas strips was laid transversely across the center of each bed in such a position that it would come directly under the patient's buttocks before the patient was put in. Over each bed on the ceiling of the car were two heavy screw eyes, one over the center of the bed, the other over the aisle. When it was desired to move the patient from the bed, a stretcher was brought to the bed side, two small blocks and tackle were hooked into each end of the strip, to the corresponding rings in the ceiling, and by pulling on these the patient was brought out over the stretcher.

The cross channel hospital ships, I understand, furnish nourishment and reinforce dressings. Their run cannot take more than six hours and probably nearer three.

At La Panne ambulances are used to a limited extent for hospital purposes—passengers, baggage, and for some special supplies—to and from Calais, 40 miles distant. They are of different makes, many of them from Antwerp, converted heavy touring cars. The bodies are as various as the cars, but all are well made. The man in charge of them, a highly educated Belgian, must have had 24 large cars. Cases were taken to the rear in trains of 6 or 8 cars, and brought from the front by other ambulance companies in the zone of fire, as well as by ours. The director of ambulances believes in a car of at least 14 to 16 horsepower (French) and says the best arrangement is for six litters.

The problem of the disposal of the soldiers equipment is most important. It is solved by taking five cases only, and using the sixth litter for the equipment. One kind of body has a trolley arrangement made by having the suports for the stretcher handles suspended from wheels which run on longitudinal tracks. It is well liked and greatly facilitates loading and unloading. All bodies with central posts hinder this work. An excellent arrangement was one that used permanent, longitudinal seats to support two out of the three lower stretchers, the third being on the floor while the upper three were held by a support which, when not in use, folded against the side walls of the body. Another very good type had hinged central posts which folded out of the way when used for other than stretcher cases.

An interesting French variety was built with three tiers of two stretchers each with an elaborate arrangement of springs. It was cold, there was no place for equipment, and a lot of time was consumed in fastening curtains and stretcher handles. It would seem that the two top cases must get a lot of motion. Two of my men who rode recumbent on the lower tiers commended the arrangement of the springs. A device which I saw on a horse ambulance was a longitudinal seat on each side, hinged so that it could be turned over toward the center to support a litter. A long, narrow tool box on the floor between the central posts seemed to utilize space which otherwise would have been wasted. All wooden wheels in Belgium have straw ropes woven around the axle near the hub. In dry weather the straw is kept wet and prevents loosening of the spokes. A good ambulance must have a tight back curtain or it will become very dirty and filled with gas fumes. Ventilation must be provided for at the front or sides, and the exhaust must not be at the rear. Heating arrangements are desirable; a large lantern will do the work.

In regard to the Ford car the drivers tell me that it is best used for three recumbent patients, two on the floor and one suspended in the center above. Four somewhat overload it. The car carries four sitting,

on adjustable cross seats well forward. The body has a lot of overhang. The Fords have done exeellent work, on account of their weight, and stand up well under hard, continuous usage. Repair cars accompany each unit. I understand that the steering knuckle has to be replaced occasionally. Four holes are cut in the tail board to admit the long litter handles. To keep the car from becoming too cold on that account, canvas bags were tacked over the opening.

It should be emphasized that fractured femurs and cases of that class should be on the floor of the ambulance where they get the least longitudinal and lateral motion.

At the front, drivers frequently slept in their ambulances, but now I hear that many have become so foul that it is no longer possible. Gasoline, tires, etc., are supplied at the military depots. The drivers are almost all civilians. As an example of the flexibility of the system, upon the occasion of a fire in our hospital many ambulance companies reported with their cars; others offered their services by telephone, and I am sure that 500 odd cases could have been evacuated to Dunkirk in at least six hours with cars available.

The heavier armored motor cars have trouble even on the Belgian roads. In one instance 18 motor trucks were broken one after the other, due to overloading with ammunition. The driver usually insists on covering the floor of his truck, no matter what the size of the ammunition or the capacity of the truck.

The best litter I saw was non-folding—the Belgian model M, 1893. It weighed 16 kgm. The canvas was laced up the back with heavy cord and had flaps to attach across the patient's ankles, wider ones for the hips and an adjustable back rest with a pocket for equipment, blanket, or pillow. Short, compact iron legs folded inward out of the way. Other stretchers were like ours but of lighter construction.

The most simple type of stretcher, and certainly the best for hospital use, if not for all uses, consists of two poles, a pocketed canvas, and two spreaders. The poles are best made of seven-eighths lumber about 2½ or 3 inches wide.

The spreader depends upon the angularity of the poles for its action. It is made of heavy strap iron and is riveted. The handles do not tend to rotate out of the hand on account of these spreaders. For work on stairways they are best left out. There are no legs on this type, but they could be easily supplied if desired.

When there is a rush of cases at the hospital, trestles are provided for the stretchers, making a satisfactory operating table. The trestles have strips nailed on top to engage the stretcher handles.

Each ambulance carries its own litters and gives up an empty litter

in receiving a loaded one. Exceptions were made in the case of a few ambulances that had a special litter and could not use other kinds. Most of the ambulances were altered so they could take any type of litter. In spite of everything the tendency is for the litters to accumulate at the rear and, if there are many casualties, many litters are needed at the front, where the motor ambulances cannot go, so reserve litters are provided at the front.

The cases which we received at Paignton were not as a rule severe. They were mostly slight cases, three days out of the trenches and they showed the modern bullet to be benign. Severe cases were received late, after they were sufficiently convalescent to stand the journey. A considerable number were septic compound fractures that required the removal of bone fragments before sinuses would close. There was surprisingly little osteomyelitis, but I am sure that Europe will be full of it for years after the war. That there is not more is due to the great recuperative power of young men in good condition. To illustrate —if a skin graft were not done at once it soon became unnecessary. To a greater extent at Haslar, when the Belgians came from the evacuation of Antwerp, and to a still greater extent in Belgium, we saw a very different picture. In both places we received cases requiring full treatment for the first time, these not being sorted out or chosen for their ability to stand a journey. The cases at Haslar showed more shrapnel wounds than cases from other sources, also a lot of bullet wounds of soft parts which did not develop gas gangrene.

I recollect but few cases where bullets had drilled soft epiphyseal bone without communition. Very extensive communition is the rule. The X-ray frequently showed diverging fine fragments of lead core from the point of contact with the bone to the exit, as though a soft lead pencil had been rubbed on the muscle. Secondary projectile of bone fragments was evident.

(To be continued.)

OPHTHALMOLOGY AS A SPECIALTY ASHORE AND AFLOAT

By Surgeon G. B. TRIBLE, U. S. N.

IN MANY respects ophthalmology in the service, whether ashore or afloat, differs widely from ophthalmology in civil life.

A large part of the work consists in examinations to determine the fitness of the individual for service, so that diagnosis and prognosis play a greater part than treatment of the existing condition. In our military service there is no dividing line—a man is fit for duty and service, or is not; no classification exists as one finds in the continental European armies, where gradated divisions are found, and the partially deficient are accepted for special service. This is properly so from our standpoint; the Army and Navy ordinarily are small—are simply a nucleus around which the various elements which go to make up the national forces in time of war may gather. With compulsory service, nonpaid, or paid a minimum, it is important that every available man be made to do his bit.

Specialism in the Navy, properly speaking, is a comparatively new development which has been rendered necessary by the growth of the service and by the progress of medicine in the outside world. Due to the severe competitive examinations and the high standards required, the military surgeon, on the average, probably possesses higher scientific training than his confrères in civil life, but it is too much to expect that he should be a specialist in all branches.

As yet it has not been feasible to have an eye specialist do only eye work. It is necessary to do ear, nose and throat as well; in fact diseases of the ear are assuming an increasingly important place, and ophthalmology as used in this article, includes its sister specialties, otology and laryngology.

Each of the naval hospitals as well as the Naval Academy, has sufficient work for a specialist. In several of the hospitals very complete equipment, adequate space, and trained assistants are to to be found. Particularly is this true at the Naval Hospital and Dispensary in Washington, where the work done by the specialist on duty is more like civil practice, at other places the proportion of women and children among the patients being very small. Afloat the only place at present equipped for special work is the hospital ship *Solace*.

Necessarily the space allowed on a ship is extremely limited,

and possibly it would interest an ophthalmologist from civil life to see how it is utilized. However, much can be done in a small space if necessary. Of course, on such a small ship, such things as waiting rooms are unknown.

On the new hospital ship there is much more room in the eye department. The booth system will be used and in that way three cases can be carried through at one time. Under the present arrangement, minor operations, or rather those performed under a local anesthetic, are done in the eye room, while all others are taken to the general operating room. On this hospital ship there is a small operating room in connection with the examining and treatment rooms, so that practically all operations in this department can be performed without recourse to the main surgical division.

Throughout the year operative work is quite an important factor, conditions requiring simple treatment being usually retained on the respective ships, or returned to the ship as soon as practicable.

At present the functional examination of the ear is very difficult, because of the practical impossibility of securing quiet, but to a certain degree this will be obviated on the new ship, for it is the intention to put in sound-proof bulkheads around this department. Refractions under the ages of forty to forty-five years are usually performed under cycloplegia. This is imperative in the cases of midshipmen, since a certain percentage of cases, presenting spasms of the accommodation, simulating myopia, is found every year.

When with the fleet, to avoid confusion and to facilitate the work, the following system has been evolved. A medical officer on board any of the ships finds a case which, in his opinion, needs an examination of the eye, ear, nose or throat by the specialist on board the hospital ship. He then sends a signal, officially, to the medical officer in command of the hospital ship, requesting an appointment. This is referred to the special department, and the first available time is given. Naturally, in case of an emergency, examination is made at once, or the patient can be transferred directly as a hospital case.

A report of the result of the examination, and any recommendation regarding treatment or the advisability of operative procedures, are made in each case and forwarded through official channels to the medical officer requesting the examination, or in some cases the data are entered directly in the health record. Prescriptions for glasses are given directly to the patient, who must provide them himself. A copy is entered in the health record and, when practicable, the patient returns with the glasses to have them checked up.

A case requiring operative treatment is admitted as a regular patient. In general this routine is followed elsewhere in the service.

To give an idea of the nature and extent of the work carried on, the reports of the work in this department for the winter drill season of 1915 and 1916 will be given:

February 21 to April 2, 1915

Eye treatments and examinations	299	
Refractions	47	
Ear treatments	160	
Nose treatments	143	
Throat treatments	64	
	—	713

Major Operations

Frontal sinus, Kilian modified	2	
Mastoid modified, radical	1	
	—	3

Minor Operations

Polypi	7	
Submucous resections, septum	3	
Turbinotomy	1	
Septal spurs	2	
Cauterization	2	
	—	15

February 9 to April 9, 1916

Eye treatments, and examinations	261	
Refractions	286	
Ear treatments	370	
Nose treatments	375	
Throat treatments	264	
	—	1,556

Major Operations

Mastoid modified, radical	2	
Mastoid radical, plastic	1	
	—	3

Minor Operations

Abscess of orbit, incision and drainage	1
Adenoidectomy	2
Polypus nasal, removal	1
Polypus aural removal	5
Tonsillotomy	3
Tonsillectomy	5
Septum submucous, resection of	15
Paracentesis, drum	5

Turbinotomy	7	
Chalazion, incision and drainage	2	
Pterygium, excision of	1	
Ossiculectomy	1	
Cauterization, linear, of inferior turbinate	4	
Cyst (orbit), excision of	1	
	—	58

From this it can be seen that the eye department is extremely active during the winter drill period at Guantanamo. At other seasons there is much less to do, but even when in the navy yards, or undergoing overhaul and repair, considerable reference work is done.

The natue of the work is varied; the enlisted personnel being drawn from all walks of life and embracing men of many races, subject to many diseases, a wide field is opened to the specialist. Occasionally very unusual cases are seen, particularly in some of the out of the way places, where the field is untouched. Recently, in Cuba, the writer was fortunate enough to see, in connection with Surgeon Spear of the Navy and a native practitioner, a post-auricular fistula about 1½ inches back of the ear, and upon radical operation this was found leading directly to the sinus. The sinus was discolored, a sero-sanguineous pus and exudate were on its wall, it did not pulsate, but, after removing the necrotic tissue and bone, pulsation returned. The mastoid cells and antrum were found filled with pus and granulations. After thoroughly clearing out the cells and antrum, it was decided to leave the sinus untouched. Six weeks later, returning to Cuba, Dr. Fabier, the Cuban surgeon, sent word the case was "perfectamente bien." How this case escaped death, and why a perisinus abscess should choose to burrow through bone and discharge externally, in preference to involving the brain, is one of the incomprehensible things in surgery. Naturally, in a well-organized community, such cases are not seen.

Afloat, unusual eye cases come up from time to time and recently a dermoid of the conjunctiva came over for treatment. During several months in Mexico, many interesting cases were seen. While there seems to be but little literature on the subject, the number of glaucomatous cataracts there was astonishing. Whether the Mexican Indian is more prone to this condition than the white, or whether the cases merely were the result of neglect, it was impossible to determine.

Occasional conflicts of opinion between the military specialist and the civilian are inevitable, primarily due to the different points

of view. Again, the civilian specialist or general practitioner is fundamentally an optimist, his duty being to cheer up and alleviate the patient; while the military surgeon must be coldly and scientifically accurate. The military surgeon is familiar with the environment and circumstances under which the men of the service must live and work, is familiar with the great strains upon endurance that soldier and sailor must meet, while in a great measure his professional brethren in civil pursuits are not. The result is that the applicant for the service, or a candidate for the Academy, who has been rejected by the examiner or examining board, sometimes goes to the civilian and is assured that his case is not serious, and that there is no reason why he should not be a good risk. This may be correct, but no such latitude is given the military surgeon. The interests of the Government must be conserved and whatever sympathy he may feel for the patient cannot influence his findings. The candidate must meet the requirements at that examination or at a later one, or be rejected. Bitter experience has shown that the man or officer accepted below the requirements will, in a great majority of cases, continue below the requirements and yield a greater proportion of disabilities, admissions, and readmissions to the sick list, and final survey and retirement, than will an equal number who are equal to or above the required standards.

On the other hand, the military surgeon, and particularly the specialist, is accused of harshness, because he frequently fails to find lesions reported by civilians, particularly in obscure cases or those having a neurotic element. If sufficient lesion is not found to justify symptoms, or malingering is suspected, it is to be reported in justice to the Government and in the interests of efficiency.

Another of the great points of difference has been the question of color blindness. The examinations made are often perfunctory and the tests applied antiquated. The question of retinal fatigue, or exhaustion, and its bearing upon color perception must be considered. One may pass an examination with Holmgren's test, under good light, and with objects subtending a large angle, while the same man on watch in a fog or mist, or after prolonged exertion, may not only be useless but dangerous. The importance of this condition to the naval service has evidently not been appreciated by the civilian specialist. The same applies to the question of lighting; impossible recommendations frequently come in regarding treatment, special lights or shades, for individual cases.

These things are possible in civil practice of a better sort, but in the Navy, which is really a sort of socialistic state, and where, in general, no one can have what is not applicable to all, such things

are not practicable, and even outside they are often under the head of placebos. The question of eye rest, highly desirable in itself in certain indicated cases, cannot be put into effect in an institution such as the Naval Academy without serious impairment of the general efficiency. It is certainly equally important to select the best personnel as well as matériel.

At sea, under the best circumstances, the life is decidedly abnormal. In no walk of civil life are several hundred men of various ages, habits, thoughts, racial and individual characteristics, crowded together. The ventilation must be for a great part artificial; the light artificial; the food, while sufficient in quantity and of excellent quality, is not that selected by individual preference. Unavoidably certain irritations must ensue, petty annoyances assume a magnified import, in other words, these conditions are the very ones which cause the weak to give way. Men, who at home would have gone through life without any trouble, will under these surroundings develop latent weakness.

The problem of ear protection from the effects of noise and gunfire has not been worked out yet. Actual rupture of the drum is comparatively rare, but in a broader sense the impairment of hearing resulting from the constant noise incident to ship life cannot be prevented. The impossibility of avoiding draughts, overheating, exposure to winds and rain on the deck, all tend to provoke catarrhal troubles. Tonsillitis, influenza, not to mention coryzas, and in fact all the diseases incident to crowding, tend to provoke and perpetuate catarrhal and suppurative middle ear affections. External otitis of a peculiarly virulent form is frequently seen. A sort of diphtheritic membraue will form in the external auditory canal, involve the drum, ulcerate through it, and leave an extremely obstinate chronic suppurative otitis media. No definite agent can be found; it is a clinical picture that may be produced by several bacterial organisms or moulds and is probably favored by prolonged maceration, such as comes from swimming for a long time and not drying the ears, or swelling and pressure of impacted cerumen. High diving, by direct violence, is responsible for a number of cases of ear disease, particularly if there had been a serious weakness of the drum adhesive process or dry perforations. The incidence of syphilis, with its eye, ear, nose and throat manifestations and sequellae, is responsible for quite a bit of work.

It might be well to mention here that the writer's experience in the navy is that direct involvement of the auditory or optic nerve following salvarsan has been extremely rare. Practically nothing has been seen that could not have been caused by syphilis alone.

A little wider field is embraced in specialism in the service, whether ashore or afloat, than is usually considered belonging directly to ophthalmology in civil life.

The great question of artificial illumination of various types, good, bad, or indifferent, comes to the front. In a general way this confronts the naval surgeon, whether specialist or not, but more particularly the ophthalmologist.

Great advances have been made and are being made yearly in illuminating engineering. The peculiar conditions on shipboard render it impracticable for the most part to take advantage of all these improvements. The question of eye protection for those working at welding or with searchlights and, to a lesser degree, those compelled to do close work under artificial light, is an important one confronting the specialist at sea.

The problem of preserving the vision of midshipmen, and the study of the causes of deterioration in visual acuity and the production of myopia, have not been satisfactorily solved. Comparative study is hard to make. Other institutions of learning, such as the great universities, for the most part have but little control over the student body, and in but few cases are accurate records kept of the vision upon entrance, the effects of study or of the influence of the various types of illumination. In a manner the government institutions are expected to take the lead, so that the service ophthalmologist is not able to draw upon their records and experience for assistance.

The winter practice in Cuba and the possession of tropical naval bases have brought up the question of glare and the effects of the bright tropical sun, especially marked when reflected from the sand or water. Several types of tinted lenses have been tried, with varying success.

The increasing importance of aviation has opened a new field, and it has not been definitely determined just how acute vision and how good hearing an aviator should possess. The question of equilibrium control brings into action the application of Barany's researches in nystagmus and the pointing reactions, and the experiments of Von Stein.

The determination of exactly the minimum vision for a gunpointer or a signalman, and the visibility of signal lights at sea, are all questions which confront the ophthalmologist afloat, and are in many instances questions which no previous training in the specialty under usual office or hospital surroundings has touched. Many examinations of the vision and the static refractions of gunpointers were

made a few years ago by Surgeon Grow of the service, and while in isolated instances men with defective vision were found to have excellent records, yet, as a rule, men with no refractive error, all other things being anything like equal, are much more efficient. While very young, and with good accommodation, marked errors of refraction may be overcome; as the man gets in his thirties and the power of accommodation becomes less, these latent conditions gradually become manifest. This of course refers to hypermetropia and hypermetropic astigmatism. Conditions of field service, or where nervous tension exists, may cause relaxation of the accommodation and consequently diminution of vision. A recent case, on board the U. S. S. *Solace*, illustrates that condition. With previous good vision, though a history of having worn glasses, a corporal awoke one morning during a march from Puerto Plata, D. R., on Santiago, D. R., and found that he could scarcely see. On reaching this ship, his vision was about 20/200, each eye. Refraction under atropin showed O. D, plus $4.25 = \overline{C}$ plus 1.25 cyl ax 60 gave vision of 20/20, and O. S. plus $3.50 = \overline{C}$ plus 2.25 cyl ax 120° gave 20/40 plus, increasing later to nearly 20/20 left. Without refraction under a cycloplegic, this man might have been considered a malingerer or a coward, since there was no external condition to account for his symptoms.

Actual malingering is extremely rarely seen in peace times; frequently patients exaggerate their symptoms, either intentionally or otherwise, especially the neurotic type. It was so easy then for men to purchase discharges that malingering for the purpose of escape from the service was rare. The constitutionally inferior are in the service as well as out, and no system of recruiting can entirely eliminate them.

In other espects the specialties run parallel ashore and afloat, in the service and out. As a rule the Government is a generous provider of instruments and equipment, and books of the best are supplied, so that the practice is more satisfactory in many ways than in civil life. Particularly is this true so far as the facilities for a complete examination and study of cases are concerned. A well-equipped laboratory and X-ray outfit can be called upon in any hospital, and in case there is any obscurity in diagnosis, or there exist certain symptoms pointing towards a systemic disorder, of which the eye or ear condition is but a part, general examination can be made and confirmed by the other members of the staff. On the other hand, the specialist is frequently associated with general cases as a consultant, and in this way there is less tendency to become self-centered, and a breadth of view can be maintained.

LOCAL ANESTHESIA

By Lieutenant Colonel CHARLES R. REYNOLDS
Medical Corps, U. S. Army

IN THE history and development of local anesthesia since the beginning in 1884, five events have occurred to add to its importance or perfect its methods, namely, the use of weak solutions with adrenalin, the discovery of novocain, injection by the intraspinal and venous methods, the use by Crile of local anesthetics in anoci-association operations, and a more careful study of sensory nerve distribution. While it is true that the ideal anesthetic will be one that suspends consciousness without shock or danger, the use of local anesthetics must be considered superior in many cases to any general anesthetic. Local anesthesia is today more popular in Europe than America. In 1909 Neuber's statistics from the clinics of 112 German surgeons showed that 25 per cent of cases which ten years before were given general anesthetics were done under local anesthesia. The Surgeon General's report shows about the same number of operations under local and general anesthetics.

Local anesthetic operations are usually time consuming and tedious and often as nerve racking to the surgeon as to the patient. It is quite natural that surgeons should hesitate to place themselves day after day under such psychic shock-producing stimuli and insist that the patients themselves should stand a share of these anoci-associations. Ether is good enough for many major operations, but for minor operations, and especially in those cases in which the patient's vitality is low and the shock-producing inhalation anesthetic might turn the balance, the employment of local anesthesia alone or with light ether or nitrous oxide is certainly demanded. Ether, while it produces unconsciousness and thus eliminates some of the psychic shock, does not block the afferent tracts to the brain or nerve centers along which may pass the harmful shock-producing stimuli from the mechanical damage in the field of operation. Local anesthetics do block these harmful impulses and so conserve the patient's vitality. This is the basis of Crile's kinetic theory of shock and of the anoci-association operation—an advance in surgery which has brought its benefits to the patient, who needs both his strength and the operation.

Through the pioneer work in neuro-regional infiltration by Halsted,

Cushing's application of the method to hernia and brain operations, the work of Matas and Braun in widening and perfecting its methods, to Lennauder's studies in sensory nerve distribution and Criles' use of novocain with or without nitrous oxide, the local anesthesia operation has included the cranial, thoracic and abdominal cavities, and almost any operation which is not prevented by mechanical reasons. Trephining, laparotomies, amputations, disarticulation of the shoulder girdle, resections of joints and of the upper jaw are numerous. Hoertel reports 16 resections of the Gasserian ganglion under local anesthesia. In 1915, Webster reported 14 abdominal cesarean sections and Ruge 22 total hysterectomies under novocain. William J. Mayo, in his notes of the clinics of Germany, Belgium and Great Britain, states that he saw Wilms of Heidelberg do two perineal prostatectomies under novocain in three minutes each.

The Various Local Anesthetics.—The most important local anesthetics today are cocain, beta-eucain, tropococain, stovain, novocain, quinine and urea and alypin.

Cocain was the first of these substances to be employed, being used by Koller in 1884 for operations on the eye. At first strong solutions were in use, 5, 10 or even 20 per cent. At the present time those who are doing the most work with local anesthesia employ two solutions, 1 per cent and 1/10 per cent, the first for nerve blocking and the weaker solution for infiltration. The poisonous properties of cocain are well known, but most cases of poisoning have been due to the use of strong solutions. Cocain enters into chemical combination with the protoplasm, having a predilection for nerve tissue, and is then broken up into harmless compounds in which form it is eliminated. Cases of poisoning are therefore due to the employment of solutions containing a quantity of the drug in excess of that which can chemically combine with the protoplasm, the excess only being absorbed into the circulation to affect the higher nerve centers and cause systemic effects. It has been demonstrated that five times as much cocain can be injected into the tissues in a weak solution as in a concentrated solution. The employment of adrenalin and the use of an elastic ligature to block the circulatory absorption of the drug have done much to lessen their danger. The poisonous dose is given by the German Pharmacopoeia as .050 gram. Death has been caused by 7 c.c. of a 1 per cent solution in the urethra. The first symptoms of poisoning are restlessness and dizziness, followed by disturbances of respiration and delirium. The best antidote is amyl nitrite, artificial respiration being relied upon when the respiration fails.

Contrary to the general idea, cocain solutions may be sterilized by

boiling for five or ten minutes. Only fresh solutions should be used and prolonged and repeated boiling injures the drug.

Beta-eucain is about one-fourth as toxic as cocain and nearly as effective. Anesthesia is produced more slowly and wears off more quickly. A number of cases of sloughing have been attributed to beta-eucain, probably, however, without proof in view of many good reports following extensive use.

Tropococain has been used extensively, especially in spinal anesthesia. It is about one-third as toxic as cocain, is a vaso-dilator and therefore directly opposed to adrenalin, with which it is not to be used. This eliminates it, to a great extent, as a useful local anesthetic.

Stovain, a synthetic preparation first brought out in 1904, has not established itself as superior to cocain or other local anesthetics. Locally it is more irritating and causes to a certain extent a motor paralysis. It is this fact that makes its use in spinal anesthesia dangerous on account of the possible involvement of the respiratory muscles and higher motor centers.

Novocain is undoubtedly the best local anesthetic. Alone it has comparatively feeble anesthetic power, but combined with adrenalin or corresponding synthetic preparations, such as suprarenin, it makes the ideal local anesthetic. It is about one-tenth as poisonous as cocain, absolutely unirritating locally, and its solutions can be boiled without deterioration. While it can be used in solutions as strong as 5 per cent, most surgeons use ½ or ¼ per cent solutions, the former in the Mayo clinic and the latter in Crile's. The employment of these weak solutions has done more than anything else to advance the cause of local anesthesia. By the infiltration method as much as .600 gram (about 10 grains) have been used without poisonous effects. This means that with a 1/400 solution of novocain with suprarenin, you may use as much as desired, even more than 200 c.c.

The anesthetic property of novocain is said to be distinctly increased by potassium sulphate. Braun, who is one of the greatest advocates of local anesthesia in Europe, uses a 4/10 per cent solution of potassium sulphate in normal salt solution.

Novocain solutions must be carefully prepared, by first boiling normal salt solution made with distilled water for twenty minutes, the novocain crystals are added and the solution boiled again for ten minutes. The adrenalin is then added. The novocain-suprarenin tablets of Braun are supposed to be sterile. It is best, however, to sterilize the solution as the suprarenin is a synthetic preparation and is not affected by boiling. Fresh solutions should always be prepared for every operation. Novocain solutions are precipitated by free alkalies. Syringes and

needles should, therefore, be sterilized in plain water, a matter, however, of little practical importance when using large quantities of the solutions.

Quinine and urea, in the form of the hydrochloride, were introduced as local anesthetics in 1907 by Thibault of Scott, Arkansas, who noted that the point of injection where quinine had been given for malaria remained anesthetic for some time. Quinine had been previously used for anesthetizing the mucous membranes. This remarkable substance is especially valuable because the anesthesia lasts for several days and has been of value in preventing post-operative pain in the incisions, the stitches and the activity of sphincteric and other muscles. Its solutions are distinctly irritating to the tissues and should not be injected into infected areas, for by diminishing tissue resistance such may lead to infection. A number of cases of extensive sloughing apparently have been caused in this way. The most rational method is to inject the tissues at a distance from the incision with a massive infiltration of a 1/6 to ½ per cent solution.

Alypin seems to be the favorite local anesthetic in genito-urinary surgery. By the use of tablet depositors the urethra may be anesthetized, or a 5 per cent solution may be injected into the urethra or the bladder. Solutions of alypin may be boiled for about five minutes.

Adrenalin and allied synthetic preparations greatly increase the anesthetic power of cocain and novocain, but have little or no effect when used with beta-eucaine and tropococain. By its vasoconstricting action it confines or incarcerates the drug in the tissues, lessens systemic absorption, and in addition seems to have a specific effect in promoting the action of the anesthetic, which has been likened to catalysis or the effect of a mordant or fixing substance. In the proportion of one part to a million it has this effect. One drop of a standard adrenalin solution, which is a 1-1000 solution in 20 c.c. of the anesthetic solution, will equal about 1-600,000. The synthetic substitutes can be boiled. Of these, suprarenin and arterenon are about the same as adrenalin. A later preparation known as homorenon is fifty times less toxic than adrenalin and in some clinics is used exclusively.

Plain water may be used for anesthetic solutions; but normal salt is preferable because, being isotonic, it neither gives to nor abstracts fluid from the cells or the nerve substance and therefore avoids the pain of the injection.

The average soldier is a good subject for local anesthesia. The operation is easy in direct proportion to the self-control or nervous strength of the patient. In nervous women and in children it is practically impossible. The preliminary preparation of the patient differs

from that for an inhalation anesthesia chiefly as regards the diet. The stomach need not be empty, a little food an hour or so before the operation being beneficial. Getting the confidence of the patients is something that almost never happens, for they all expect to be hurt but are willing to chance it to avoid ether. The procedure should, however, be explained, the advantages such as elimination of nausea and vomiting, the ability to eat, drink or smoke soon after the operation, being mentioned, and the patient should be told that at any time during the operation if pain be felt he should say so, as suffering is not a part of the operation and can be easily prevented by the use of a little more cocain. As the operation is likely to be long and tedious, the position on the table should be comfortable, a pad under the small of the back being especially required. The arms should be secured to the sides or across the chest, and someone should be in attendance at the head of the table to take the part of the so-called "moral anesthetist."

About half an hour before the injection is made, a hypodermic of ¼ gr. morphine, with or without scopolamine or atropine, should be given. This is very important, for without it the psychic strain is apparent and the general attitude of the patient is far less satisfactory.

Two solutions should be ready, a 1-400 novocain with adrenalin for infiltration and a 1-100 solution for nerve blocking or injecting hypersensitive or missed areas. If quinine and urea are to be used, a 1-400 solution will be found satisfactory. A 5 c.c. Ricord syringe is the most satisfactory for general work. A fine needle is to be used for the skin and a longer and large one for deep infiltration. For the quinine and urea an angular needle is best so that the area about the operative field can be blocked off. The operation can now be performed by one of two essentially different methods. In the first case the skin itself is infiltrated and each layer is anesthetized as the incision deepens, every nerve being infiltrated as it is found. In the other, the filed of operation from below upward is infiltrated or the field of operation is circuminjected in order to anesthetize the nerves before they reach the skin or operative field. In this case, from fifteen to thirty minutes should elapse after the injection before the operation is begun.

In operating by the first method, with a fine needle the solution should be introduced into the skin itself between its two layers, for the skin is the most sensitive tissue of the body. A wheal is thus formed whose surface is white and pitted, looking like pigskin. Neglect to anesthetize the skin itself is the most common error. Through this wheal to its periphery the needle is passed, another injection made slowly, and so on until the line of incision is covered. In the same way the successive layers are painlessly anesthetized. If the other method is

chosen—as, for instance, in a hernia operation—the point of the needle, preceded by its wheal, is carried to the entire extent of the proposed incision, infiltrating the subcutaneous tissue, apponeurosis, muscle cord and Poupart's ligament. In half an hour the operation is commenced. If practicable, a constricting bandage should be applied about the part after the injection if cocain has been used. Massage of the injected area is supposed to assist in the dissemination of the solution. In operating in an inflamed area the infiltration should be made around the area and not into it, as this is always very painful and the anesthesia unsatisfactory. Boils, abscesses, carbuncles, and felons can be painlessly incised if the injections are made properly and given time to permeate.

In the general conduct of all extensive operations under local anesthesia, the tissues must be cut, not stretched, pulled or torn, as these procedures cause plain by dragging upon structures quite outside the operative field.

Neuro-regional anesthesia or the nerve-blocking method, by which the sensory nerves of the operative field are anesthetized, either in or remote from the field of operation, was practiced the same year that cocain became known as a local anesthetic, by Halsted, who blocked the inferior dental nerve for the extraction of teeth. As early as 1887, Crile amputated a leg after blocking the sciatic and external cutaneous nerves. In 1900, Cushing greatly advanced the subject of local anesthesia by the publication of his method of hernia operation by paying especial attention to the ilio-hypogastric, ilio-inguinal and genito-crural nerves. Since that time, painstaking investigation as to the sensory nerve distribution, especially by Braun and Lennander, and methods of attacking large trunks have made possible a broad field for local anesthesia. The injections are of two kinds, peri-neural and intra- or endo-neural. The injection into a large nerve trunk is not painful if the nerve is slack. Histologically a few fibers or cylinders have been degenerated by this injection, but clinically no instance of permanent anesthesia or paralysis has ever followed a neural injection of an anesthetic solution.

Venous anesthesia is a method of producing local anesthesia by injecting the anesthetic solution into a vein and was first described by Bier in 1908. The limb is bound tightly from the fingers or toes upward with a rubber bandage as in the ordinary bloodless operation. Above the bandage an Esmarch roller is applied. The first bandage is then unwrapped from the limb peripherally so as to expose the area of operation. Novocain solution ½ per cent, without adrenalin, is then injected into an exposed vein, as much as 50 c.c. being used in the upper and 70 to 80 in the lower extremity. The area between the bandages becomes anesthetic almost immediately and the limb peripheral to the

distal bandage becomes anesthetic and paralyzed in five to ten minutes. This anesthesia lasts while the bandage remains in position. The method has been found satisfactory for practically any operations upon the extremities. The same method, in which the solution is injected into an artery (arterial local anesthesia), has been used, but possesses no advantages over the venous method.

Intraspinal or sub-arachnoid anesthesia is not obsolete but will continue to have its place in certain classes of cases. Novocain is probably the best drug, although cocain, stovain and tropococain are still used. Crile's experiments with methylene blue injected in this manner showed a very rapid dissemination to the upper regions of the cord, regardless of whether the patient was sitting or recumbent. Stovain's affinity for motor nerves would seem to prejudice its uses on account of the danger of its action on the motor nerves and centers of respiration. The use of adrenalin with the anesthetic is debated, some using it and others omitting it in spinal anesthesia. The chief disadvantages of the method, as stated by Crile, are its effect in cutting off the vasomotor control of the splanchnics and lower extremity, its mortality, the psychic strain produced, the frequent incompleteness of the anesthesia and subsequent headaches.

In applying the principles of local anesthesia to special surgical operations, it is essential that the irritability or sensitiveness of the various tissues of the body should be known, as well as the distribution of those nerves which carry impulses of pain, touch, heat and cold. In general, the integument of the body is supplied with these nerves and is very sensitive. The subcutaneous tissue, fat, fascia and muscles are very much less sensitive and in many places quite insensitive, except in the vicinity of traversing nerve fibers. Periosteum is exceedingly sensitive, bone is insensitive, so are cartilage and fibro-cartilages of joints. Bone marrow is said to be insensitive, although J. F. Mitchell states that the marrow of some long bones is sensitive. Synovial membrane is acutely sensitive. The dura, brain, and most of the internal viscera are insensitive to any of the sensations and may be cut, crushed, or burned without pain. Tumefactions and granulations are also insensitive unless the manipulations result in traction on adjacent structures—a fact to be borne in mind in any operation about the internal organs and viscera.

In operations on the scalp it should be remembered that the skin, fascia, and periosteum receive their nerve supply from below so that the anesthetic solution should be injected below the seat of operation. With the periosteum anesthetized the bones can be drilled, trephined, or gouged without pain. The dura is sensitive only under the oc-

cipital bone; the brain itself needs no anesthetic as it is insensitive and has no noviceptors. Incisions and lacerations of the brain, therefore, cause no pain or shock.

In operations on the superior and inferior maxilla it must be remembered that through these bones are transmitted the branches of the fifth nerve. The best neuro-regional work ever done has been applied to the fifth nerve. Properly placed injections around the supra, and infra orbital, the posterior, anterior and inferior dental nerves have rendered painless operations on the jaws and the extraction of teeth. Matas has resected both upper jaws and sixteen resections of the Gasserian ganglion have been done by Hoertel.

Operations about the ear and paracentesis of the drum membrane can be done by two injections, one at the upper attachment and the other in the furrow between the articulation and the mastoid, from which the injection is made subcutaneously and along the auditory canal. After applying one per cent cocaine solution to the drum, paracentesis can be painlessly done in ten minutes. The mucous membrane of the middle ear is very sensitive. Although in 1908 forty radical mastoid operations had been done in Politzer's clinic, the operation is certainly one for inhalation anesthesia.

For tonsil operations in adults the peritonsillar injection, that is, about the capsules, is entirely satisfactory. The use of quinine and urea is especially recommended for this purpose.

In the nose, when a limited area is to be treated, the stronger cocaine solutions—5 or 10 per cent—are used, although a 1 per cent solution will suffice if a sufficient time is allowed for it to act.

Tracheotomy is a procedure which in most cases must be done without inhalation anesthesia. Many have been done without any anesthetic. Years ago Brown-Sequard called attention to the fact that in this region the tissues are practically insensitive exactly in the median line. The operation is easily performed under infiltration and the application of the solution to the mucous membrane of the trachea.

Thyroid operations, the ligation of the arteries or poles or removal are entirely feasible under novocaine. As many other matters have to be taken into consideration, and especially the psychic effect, it is often advisable to use nitrous oxide or ether in conjunction with novocain.

For ligation, a horizontal line of incision 2½ inches long across the center of the thyroid cartilage is infiltrated, and a deep injection is made on either side. The thyroid gland itself is insensitive. By a sharp dissection and the avoidance of traction the operation can be done painlessly. Before ligating the poles an injection should be made around the capsule as the tying of the ligature is painful. As a pre-

liminary operation, Crile does this while the patient lies in bed. For removal of a lobe, after infiltrating the line of incision a deep injection is made into a quadrant to the outer side around the lobe; finally, a massive injection is made along the posterior border of the sternomastoid muscle to prevent the disagreeable drugging sensations necessary in removal. Sixty to 80 c.c. of novocain solution are used.

Operations on the thorax for lung and pleural conditions often preclude the use of ether. Paracentesis, rib resection and incision for abscess of the lung can be done painlessly if it is remembered that the skin, periosteum and parietal pleura are sensitive, the bone and the lung substance being neutral. The infiltration should be made over the rib, in the adjoining interspaces, into the periosteum and behind the rib. The pleura may be injected at first or when it is exposed in the wound.

Complete breast excisions have been performed under local anesthesia. While it is not an ideal location for this method, the minor procedures, such as incisions or the removal of benign tumors, are easily performed under infiltration.

Almost any simple abdominal operation can be done under local anesthesia. If the surgeon is sure of the diagnosis, any chronic appendix, for instance, can be removed; but the method possesses the distinct disadvantage that a thorough exploration of the cavity is not very practicable because of the necessary traction on the parietal peritoneum and other sensitive points. Abdominal incisions present no difficulty whatever, and by making long incisions the infiltration produces a more flaccid and relaxed wall than in the surgical stage of ether.

The nerve supply of the abdominal area has been very carefully worked out. Most of the wall is innervated by the intercostal and lumbar nerves, which course forward between the internal oblique and transversalis as far as the rectus sheath. Perforating and connecting branches supply the skin, muscle, fascia and parietal peritoneum. The diaphragmatic peritoneum, however, is supplied by the phrenic nerve, a point which is of most importance and complicates operations in the upper abdomen. It has been shown that all the viscera which receive innervation from the vagus or sympathetic system are devoid of the sensations of pain, pressure, heat and cold. The stomach, intestines, liver, and practically all of the viscera may be cut, crushed or burned without pain. Traction, however, as it affects the mesenteric or other attachments to the parietal peritoneum, causes pain. This is true also of the kidney, ureter, and bladder. A stone in the ureter or gall ducts causes pain by disturbing the investments of those ducts, especially in the presence of inflamed tissue.

Crile, in advocating the use of local anesthetics in abdominal surgery, either alone or with nitrous oxide, as a part of anoci-association, gives a hypodermic of 1/6 grain morphine with 1/150 scopolamine one hour before the operation. The skin line is then infiltrated, and the incision is made through the fat, which is practically insensitive, to the fascia. This is infiltrated and cut, then the muscles, posterior sheath and finally the peritoneum are treated in the same way. When the abdomen is opened a massive injection of the wall, at a distance from the incision on each side, is made with quinine and urea. Crile lays down these general rules: Make large incisions, avoid rough handling of tissue, traction on the parietal peritoneum and mesenteries, use retractors gently, and avoid gauze pads and sharp dissection.

As thus performed, the surgeon has the advantage of a well-relaxed wall, which avoids extrusion of intestinal coils, does away largely with gauze pads, in the post-operative period avoids nausea and vomiting and gas pains, and causes fewer cases of hypostatic congestion of the lungs, by permitting the pain-free muscles to take their part in the process of respiration.

In operations on the anus and rectum it should be realized that the anal skin and mucous membrane are exceedingly tender, but the upper rectal membrane is quite insensitive. Injections should be made at a distance from the muco-cutaneous junction and the solution carried inward. External hemorrhoids, fissures and fistulas may be easily treated by simple injections. Internal hemorrhoids and operations requiring complete relaxation of the sphincter are more easily done under ether. But with novocain it is possible to stretch the sphincter fairly well without much pain. The novocain solution should be injected in four places around the annal margin, then the sphincter is infiltrated with a guiding finger in the rectum. Finally quinine and urea are thrown in about the sphincter to control the post-operative period. In this hospital[1] for some time past, after ether operations for hemorrhoids the area about the sphincter has been infiltrated with quinine and urea. The post-operative period is quite painless. I have often doubted the entire safety of this procedure on account of the poor resistance of the ischiorectal region with its terminal blood supply and proximity to infected areas.

Gynecological operations have been performed under local anesthesia, but this method is not well suited to these cases. Krause, by an ingenious method, has dilated and curetted painlessly by the use of Hegar's dilators coated with a syrup containing novocain and adrenalin.

Hernia and varicocele and all operations on the scrotum and tes-

[1] Department Hospital, U. S. Army, Honolulu, H. I.

ticles are well suited to local anesthesia. For some time, all hernia and varicocele cases at this hospital have been operated under novocain with entire satisfaction. For the hernia I prefer the deep preliminary injection of fascia, aponeurosis, muscles, cord and Poupart's ligament, waiting a half-hour after the injection. The upper or outer part should receive a good injection to catch the iliohypogastric nerve which supplies the skin. The area at the neck of the sack is injected before tying. For varicocele, the transverse injection is used and with good infiltration of the cord there should be no pain. In operations on the scrotum and testicles the neck of the scrotum should be infiltrated all around, being careful to include the suprapubic and perineal areas of attachment. Infiltration of the cord will then be sufficient, unless the operation is to involve the testicle itself; in which case an injection should be made about the hilus and epididymus, as these places are sensitive. The "bottle" operation for hydrocele is easily done under local anesthesia.

Circumcision is essentially an operation for a local anesthetic. Of the many methods, a satisfactory one is to fill the prepuce with 1 per cent cocaine and adrenalin solution and, after a few minutes, infiltrate the skin line, cut and reflect, infiltrate the mucous membrane from the skin side and slit it, then infiltrate the line of incision in the mucous membrane with special attention to the area of the frenum. Massive infiltration of the base is also employed.

Urethral operations, exposure of the bladder by the suprapubic method and prostatectomy by either route are operations that often preclude the use of ether. The urethra can be anesthetized by 5 per cent alypin, 1 per cent cocain or novocain solution. All operations on the bladder should be preceded by the injection of 60 to 80 c.c. of 5 per cent alypin, 1-1000 cocain or novocain solution introduced into the bladder through a catheter, which is left in. In exposing the bladder after infiltration care must be taken to avoid traction, which is intensely painful in the presence of acute inflammation. The prostate is removed after injecting the solution into the bladder mucous membrane and about its capsule.

In operations on the extremities, nerve blocking and attention paid to the sensibility of the various tissues will allow many of the major extension operations. The muscles and tendons are slightly sensitive and so are the ligaments, except that of the patella. The periosteum and synovial membranes are exquisitely sensitive. In operations on the fingers and toes it is necessary to infiltrate in the vicinity of the four nerves, two anterior and two posterior. It is said that the intravenous method allows all kinds of bone surgery, the reduction of fractures, wiring, plating, operations for necrosis and joint operations.

BRIEF STUDIES IN FLAT FEET[1]

By Lieutenant Colonel GEORGE H. R. GOSMAN, M. C.
and Lieutenant H. P. PERRY, M. R. C., U. S. Army

(With six illustrations)

IT IS a safe and true saying and quite beyond dispute that any soldier's efficiency, whether he is of infantry, cavalry, provisional field artillery, or any other department of the service, is only equal to and parallel with the integrity and soundness of his feet.

Any soldier who through any deformity of his feet is unable to go the limit of muscular exertion that his musculature will permit, is himself not only below par in efficiency but because of his inefficiency, the efficiency of the entire company is lowered, as any man invalided for any reason whatsoever, removes from activity at least one and usually two others from the immediate field of operations.

It is the purpose of this paper to discuss flat foot in the soldier, its prevention and treatment among men in the military service of this country. The opinion and deductions herein expressed and deduced are based upon observation of these cases and the treatment carried on at Fort Ethan Allen since August 1, 1917.

During August at the 18th Cavalry Camp, talks of instruction were given to the troops twice or three times each week, a definite plan of exercises inaugurated, and personal attention given to many individual cases.

The results were most gratifying, even though the exercises were not personally supervised at all times by a medical officer. The men were then allowed to conduct and carry on the exercises without supervision or instruction beyond what was embodied in the lectures to the troops. In this regiment alone, about 300 men were found with distinct symptoms referable to flat feet. Over 80 per cent of these men were within a month made thoroughly efficient.

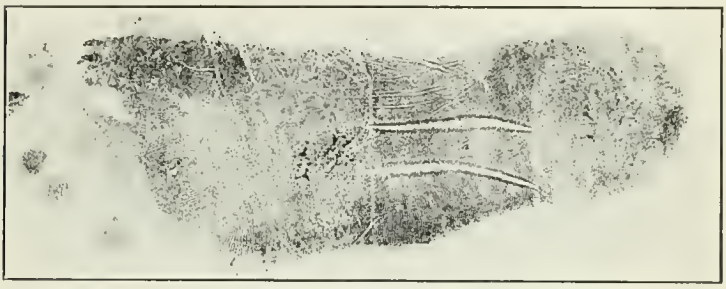
Since September 17, men from other regiments have been under observation and treatment at the Recruiting Barracks Hall in squads of forty or less. The results noted and the form of exercises are detailed in this paper.

Talipes planus, for the sake of some form of classification, is divided into three groups, the first, second, and third degrees.

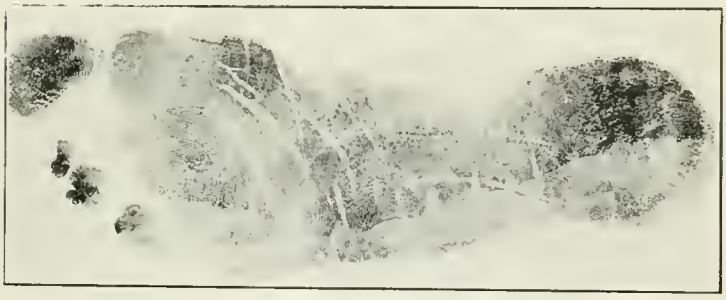
In recruiting examination papers this classification is the one considered and papers are marked, "with or without symptoms," meaning subjective symptoms, namely pain, impaired motility or lameness, as admitted by the man under observation. Men who in civil life acknowl-

[1]See The Military Surgeon, August, 1917, p. 219.

Normal Left Foot Imprint.



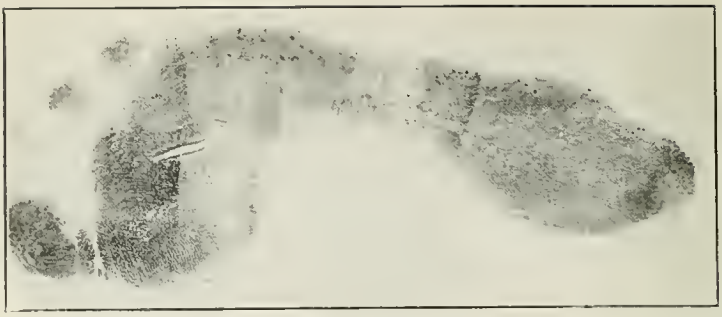
Flat Left Foot Imprint before Exercise.



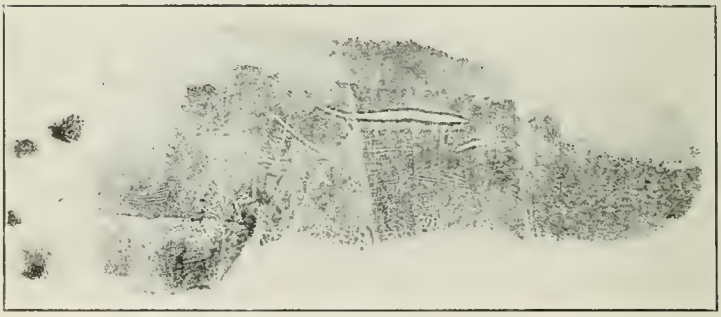
Flat Left Foot Imprint after Two Weeks' Exercise.

Imprints are made by applying ordinary finger print ink to sole, after which the foot is placed on the paper lying on the floor and the man directed to stand squarely upon it.

(To face page 56.)



Normal Right Foot Imprint.



Flat Right Foot Imprint before Exercise.

Flat Right Foot Imprint after Two Weeks' Exercise.

edge no impairment or disability are marked symptomless on the examination papers and are enlisted.

Observation and study of this class of cases compel the conclusion that every case of flat foot does give symptoms sooner or later if subjected to intensive training.

Though it is not intended in this paper to quote statistics, a few approximate figures may not be inappropriate, the endeavor being in quoting figures to lean positively to the ultra conservative side.

In about 2,000 cases examined and closely observed at various recruiting stations throughout New England, the writers estimate that about 30 per cent, or about 600 men, suffered from flat foot either of the first, second, or third degree. Of these 600 men about 60 per cent were subjectively without symptoms and were accepted for enlistment. From this it is only a matter of mathematical calculation to determine, in an army of two million men, that a considerable percentage will be made up of men with flat feet.

Symptomless flat foot in civil life leaves the symptomless class in a very short time after admission into the army, with its system of intensive training. In from one month to five, over 50 per cent of the men who have first or second degree flat foot become to a greater or less degree inefficient, and it is our observation that it is a greater rather than a less degree. It is not intended to convey by what precedes any criticism of the recruiting examiner or his work. We do think, however, that with the experience and knowledge gained in constructing a new army, the exclusions from the services of first and second degree of flat foot will be greater than now.

It is not within the scope of this paper to discuss the recruiting officer's work, but rather to discuss some plan of treatment of *Talipes planus* applicable to condition and environment as found in the army, that will not only produce results, but will be entirely possible to carry out without *materially upsetting military training.*

In orthopedic practice in civil life it is not difficult for the man or woman under treatment to be put at rest at home or in the hospital. It is not a hardship though, perhaps, a drain on the purse, to go to the doctor two, three, or four times each week for treatment; neither is it difficult to find a shoe dealer who will sell a proper arch support apart from the shoe, or mayhap one may be compelled to pay a large price to have the arch support made a part of the shoe itself. Obviously the soldier in training can have none of this and, furthermore, we are convinced that any form of artificial support to any arch is decidedly detrimental.

The recruit in the United States Army is at once started on his course of muscle building, muscle training, through setting up exercises,

and drills on foot and on horseback. Close attention to soldierly bearing is given. In fact everything is done to make him a real man, and one only needs to see the raw recruit on his arrival at an army post and to see the same man three or four months later, to note the change. Close attention during his entire training is given to every part of his body, except his feet.

The anatomy of the bony structure of the plantar arch, the muscles of the foot and leg are quite familiar, hence a detailed anatomical review is not necessary. Neither need much, if anything, be said regarding symptoms, because the purpose of this communication is chiefly to call attention to the plan of treatment at Fort Ethan Allen, Vermont, that has been found effective and satisfactory.

Up to the time of this writing there have been about 400 cases under observation and treatment at Fort Ethan Allen. From these cases it seems that in giving a prognosis the degree, as determined by foot imprint alone, is not especially definite or positive. It does not give very much of an idea of the curability of the case whether it be of the first, second or third degree, except in a broad sense. Any opinion formed thus is largely dependent upon the observer's eye. The degree of adduction, of eversion and the degree of immobility of the toes and ankles are, however, in our opinion the determining factors as to whether the given case can be cured sufficiently to be retained in the service, as an efficient atom of a great army, or whether the case is one for discharge.

In the group of cases under observation and treatment, that have been recommended for discharge, there are six cases, all of which have been improved, as far as improving the arch is concerned, but have, despite treatment, been unable to overcome a marked degree of rigidity of the toe joints and the ankle joints. Therefore we conclude that any case of flat foot can be cured and made a useful foot, well able to bear the intensive training of the army routines, provided the inflexibility or rigidity is not of such an extreme degree as to render impossible, by proper exercises, a complete development of such muscles as are essential to proper support of the foot bones.

It is not so long ago that the gymnasium instructor advocated dumb-bells, of greater or less weight, in all drills and exercises, in fact muscle-resistance apparatus were gymnasium indispensables.

Gradually these have been reduced in weight until now very few dumb-bells are used, and the system of muscular nonresistant exercise has become the one used to develop flexible useful muscles.

In order that the systematic exercises of the foot muscles may be carried out successfully, the leg should be free from all restraints. Shoes and stockings should be removed. Under-drawers and breeches should be so arranged as in no way to restrict muscular action.

The toe exercises are the first ones taken up.[2] The men are stood on a raised platform, a two-inch plank is quite enough; they are then directed to flex the toes to the extreme point of flexion with a hard pull of the flexor muscles of the sole of the foot at the extreme point of flexion. This is followed by extension without effort. This exercise is repeated continuously from five to ten minutes, the shorter period at the beginning, gradually lengthening the time of this particular exercise until the full time is possible without fatigue. The second exercise is a continuation of this flexion of the toes on the sole of the foot, bringing into action the *Tibialis anticus* muscle. At the extreme point of inversion or adduction, a strong, hard pull is made, then the foot is allowed without any muscular effort to resume its usual position.

At the beginning, fifteen or twenty minutes are sufficient for the entire routine of exercise. Later, after the muscles become stronger, a full half-hour may be devoted to this without marked fatigue.

The plan as outlined above has been carried out each morning under the supervision, after the first few days, of an enlisted man of the Medical Department.

The patients have been instructed to repeat this performance each night on retiring, devoting one-half the time consumed in the morning.

Many of the cases with marked inversion or adduction of the foot walk with the toes turned out. The men are instructed to walk with the toes turned in at all exercises and at all times during the day. We believe that this latter advice relative to walking is vitally important in the general handling and treatment of these cases.

The following conclusions have been reached as the result of the work at Fort Ethan Allen, in the observation and treatment of flat foot.

1. That subjectively symptomless flat foot, in civil life, quickly becomes a source of trouble and invariably gives acute symptoms under the burden of intensive military training.

2. That any given case objectively showing a flat arch, even though of the first degree, should be rejected for enlistment, unless all motions of the toes and ankles are free to the extreme degree.

3. That the system of recording the degree of flat foot inaugurated at this post indicates, by comparison, the degree of improvement in motility under muscular exercise properly conducted.

4. That the method employed at Fort Ethan Allen since August 1, 1917, in the treatment of flat foot is the plan best adapted to the needs of men in the army undergoing intensive military training.

5. That the *non-resistant* exercise plan is most effective and shows results well calculated to make its adoption in military practice advisable.

[2]See THE MILITARY SURGEON, August, 1917, p. 219.

AUSCULTATION OF PULMONARY APICES IN YOUNG MEN

By First Lieutenant JOHN T. KING, Jr.
Medicol Reserve Corps, U. S. Army

AN examination of over twenty thousand men for tuberculosis has recently been completed at Chickamauga Park. While the present notes are in no wise intended as a report of the board's work, yet certain observations were made upon possible sources of error in the diagnosis of apical tuberculosis, which might prove of interest not only to those in civil practice, but especially to medical men who are just entering or continuing similar examining work among the military forces.

In the diagnosis of pulmonary tuberculosis on a large scale among men in camp, the essential object is the discovery of the largest number of tuberculous men in the shortest possible time. Laboratory methods are, of necessity, in abeyance to those of physical diagnosis. Sputum examinations are very rare, for the reason that a vast majority of soldiers with manifest tuberculosis produce little or no sputum. In this and other respects there is a difference between the diagnosis of tuberculosis in such routine examinations and similar work in civil practice. Most of the soldiers found to have the disease have few or no symptoms. The writer does not recall an instance in which such a man has felt sick enough to report at sick call to his camp surgeon; while this was not inquired into in any routine manner, it is a fact that most men with physical signs of tuberculosis have no insight into their condition. X-ray examinations may be available in camp, but it is obviously desirable, in time of war, at least, to obtain results by the least circuitous path that offers itself. Therefore, any refinement of method in physical examination which enables an examiner to detect tuberculosis in an infected soldier, or to exclude it in the case of a malingerer, will be of very practical importance in the present war.

The vast majority of physical signs of tuberculosis occur in the upper lobes. A large percentage of these signs are limited to the apices of the upper lobes. Moreover, probably at least one-half of the cases in which the signs are entirely above the clavicles, or at the apices behind, present no physical signs of tuberculosis beyond certain râles which we interpret as indicating the probability of an early tuberculous lesion. This is especially true in these military precautionary examinations, during which many cases are discovered in their very incipiency. Therefore, if we are to disqualify large numbers of men in whom are found certain sounds over the clavicles, which are interpreted as being

tuberculous râles, it is of the utmost importance that the examiner know to a nicety the sound and characteristics of a tuberculous râle; but, what is more important, he must be able to exclude with equal nicety other adventitious sounds of no significance.

After the work at Chickamauga Park was well started, it began to be clear that soldiers presented a problem in physical examination which had never been fully appreciated by any member of the board in civil work. A large number of men showed certain crackling sounds during auscultation, in the supraclavicular fossae especially, which in many cases so closely simulated râles, that their identification became the most difficult problem which had to be solved. During the latter part of the work, the writer kept a list of the men he examined, with observations of the various confusing factors which arose during auscultation of the upper lobes. These observations were crystallized and amplified by discussion with other members of the board, all of whom were interested in the same problems.[1]

Incidence of Normal Adventitious Sounds.—Notes were kept of adventitious sounds in the upper lobes in the examination of 819 men. As the examinations were brief, and the surroundings not conducive to a perfect examination, only such sounds as were brought to the examiner's attention without especial search for such are noted. In 33 cases (4 per cent), crepitations were heard at or near one or more joints. Most of such sounds emanated from the scapulae, the costo-sternal and sterno-clavicular articulations, and from the joints at the shoulder anteriorly. In 23 instances, certain crackles, usually rather loud and explosive, were heard for one or a few respirations at the apices, disappearing promptly during continued breathing. In 17 cases (2.07 per cent) there were found the persistent apical clicks or crackles, of the type which had proved so often confusing. The importance of recognizing and disregarding such sounds is obvious, when one realizes that for each man who is found to have tuberculosis, more than two men will be found who present crackling sounds at the pulmonary apices of no significance.

Literature.—The common sources of error in auscultation are amply treated by text-books, except the apical crackles, which are easily the most confusing sounds encountered in the examination of soldiers. This is probably due to the fact that such sounds seem to be much more common among muscular young men than among persons of varied ages.[2] No mention of them was found in a brief survey of the text-

[1] The other members of the board were: Capt. J. Albert Chatard, president; Lieutenants A. G. Compton, J. J. Stack, J. E. Gammon, J. H. Haldeman, James McNall, F. D. Spencer; Contract Surgeons S. P. Child and W. H. Schroeder.

[2] Rosenbach: *Berl. klin. Wchnschr.*, 1876, xiii, 325.

books by Da Costa, Cabot, Gerhardt and other authorities. Flint describes certain pulmonary crackles, which he says were first noted by Fournet as "*râles de craquement.*" Flint explains the origin of such râles as due to the separation during inspiration of the walls of a few cells which have become adherent, in the presence of a small quantity of glutinous exudation. Most of such sounds, Flint says, are indicative of early tuberculosis, but occasionally they occur in the healthy chest, in which case they are transient. He found them in two instances during the auscultation of 24 healthy chests. They were probably similar to the transient sounds noted above as occurring in 23 cases in this series. Laennec describes no apical crackles occurring in healthy individuals. Dr. Walshe has a good description of scapular and other sounds originating in the thoracic parietes, but makes no mention of apical crackling sounds. Bushnell[3] describes the various sources of error in chest auscultation, and refers to certain muscle sounds over the apices which were noted by Rosenbach over forty years ago. Roughly translated, Rosenbach says:

> In apical auscultation in the supraclavicular and supraspinous fossae and in the interscapular regions, one often hears at the height of inspiration crackling sounds, which very cleverly imitate rare, small, dry râles. Sometimes they are like pleural rubs. In children and in strong young men, I have frequently heard this sound during vesicular, clear breath sounds. The sounds do not clear after coughing; they remain the same as long as one cares to listen. They are of importance in the diagnosis of tuberculosis, but the text-books contain no note of them. The sound probably comes out of the muscles upon which the stethescope rests. It can be reproduced by gently moving the muscles while the patient holds his breath. It could not be due to friction against the skin.

Recognition of Adventitious Sounds. Joint Crepitations.—In many instances sounds originating in the joints are of such grating or groaning quality that they can be recognized at once by their sound. This is especially true of sounds from the scapular regions. Other types of scapular sounds, however, are crepitant, and demand further study. Dr. Walshe says that such sounds clear readily after a few brisk movements of the arm. Bushnell advises placing the subject prone upon a high couch, his arms dangling loosely on each side. This can be equally well accomplished by having the subject bend his trunk well forward from the waist while he stands, at the same time allowing his arms to hang loosely. Another simple procedure is to have the man grasp a support at a level about as high as he can reach, and, with his hands well apart, put enough weight on his hands to draw the scapulae well

[3] Bushnell, Col. G. E.: *Medical Record*, January, 1912.

apart and hold them in a fixed position. Putting the arms around a tree over the head was a valuable method in some cases. Sometimes the act of folding the arms across the chest to such a degree that the hands grasp the opposite shoulders causes scapular sounds to disappear. Such procedures are so simple that it is unfair to disqualify a man who presents adventitious sounds and no change in breath sounds in the interscapular region, without first subjecting him to one or more of the above maneuvers, to rule out the possibility of the sounds originating in the chest wall. Certain perfectly healthy men showed sounds in the interscapular region which were supposed to be râles, until they disappeared entirely or very markedly diminished after separation of the scapulae.

Sounds occurring over the upper front, coming especially from the sternal articulations, are often confusing, but are well described elsewhere. They are heard at or near the sternum and may be transmitted laterally along the ribs. They often simulate closely subcrepitant or crepitant râles. However, their location is characteristic, and the sounds lack a dull, sticky quality which would be found in a fine tuberculous râle occurring in the course of vesicular breath sounds. On the contrary, the sternal sounds are usually fine, dry, sharp crepitations; their size varies, but they retain the sharp, dry quality. These sounds can sometimes be eliminated by having the subject throw his shoulders back as far as possible, thus putting the lateral articulations of the sternum under tension.

Transient Apical Crackles.—These sounds, being transient, are of no practical importance. They are identical in quality with the persistent apical crackles described below. They occur as an explosion of crackling sounds, usually rather coarse, usually during only one respiration. One gets the impression that the neck muscles move with less friction after this initial breath. They are too loud for intrapulmonary sounds as a rule, and certainly originate in the parietes, probably in the neck muscles. They are probably sounds of origin identical with those heard by Flint in 2 of 24 healthy chests. Also, such transient crackles are almost invariably too coarse and sharp to be confused with so-called "atelectatic" râles. Bushnell[4] doubts the existence of marginal râles due to atelectasis in the healthy individual, believing them due to friction of the normal pleura. At any rate, such sounds seem of great rarity among young men, at the apices, though they are frequently heard anywhere over the complementary space, where the two surfaces of parietal pleura are approximated. With the exception of a case of probable apical fibrinous pleurisy, which was shown to the

[4] Bushnell, Col. G. E.: *Medical Record*, December 21, 1912.

writer by another member of the board, he does not recall an instance of transient or persistent adventitious sounds above the clavicles which he considered to originate from either pleural friction or from atelectasis.

Persistent Apical Crackles in Healthy Men.—Such sounds are more dificult to distinguish from true râles than are any other adventitious sounds heard in the upper lobes. Occurring in over 2 per cent of normal young men, the possibility of their presence should always be eliminated before a subject, who shows nothing abnormal except "râles" at the apices, is considered to be tuberculous. These sounds are of various sizes, usually rather sharp and coarse, occurring singly or in sequence. A single click at the apex, persisting at the same phase of inspiration or expiration, or both, of constant quality, in the course of normal breath sounds, not influenced by cough, should be classed in this group of normal sounds. If the sounds are multiple and very course or sharp, they are readily recognized as of no significance. If the sounds occur, as is frequently the case, during both phases of respiration, are of constant quality, not influenced by cough, and are associated with no other changes, they are presumably in the same category. Sometimes the sounds are heard clearly when the stethescope is directed inward over the clavicle toward the neck muscles, and at the same time similar sounds of less intensity are heard laterally over the lung tissue. This fact should always make one suspect the presence of normal adventitious sounds.

Rosenbach states that normal apical crackles are not so apt to be sharply localized as are true râles. However, the supraclavicular fossa does not contain much lung surface, and it is difficult to say that râles are to be found in one part of supraclavicular lung and not in another. It is the presence of the sounds in greater intensity medially, near the long neck muscles, that is more important in the identification of spurious râles. The sounds are sometimes heard at the apices behind, and below the clavicles, but such are rare compared to those heard above the clavicles. The effect of cough on true râles is well known, especially if the cough comes at the end of expiration; râles usually occur in showers after such a procedure. Usually cough has no effect upon normal apical sounds, but this is not always true. At times a cough accentuates them for one or two respirations; this is probably due to a temporary change in the relative position of the neck muscles, caused by the cough. If none of the above recognizable features of normal crackles is present, the examiner should resort to changes of position of the head to prove the sounds of muscular origin. There are many cases in which apical sounds are extremely difficult to distinguish from medium or coarse moist râles. In such cases the writer has been forced

to rely upon the variability of the sounds with change of the head's position as the sole criterion. They are usually most intense when the subject is in the position customary during examinations—with the face turned away from the side which is being examined. Sometimes the sounds clear or diminish when the face is turned forward, or when it is turned slightly toward the side that is under examination. Probably the most helpful procedure is to have the subject put the chin as far upward and backward as he is able. This extends the neck muscles and diminishes friction during respiration.

Rosenbach reproduced the sounds by moving the neck muscles while the subject held his breath. The neck muscles or tendons are obviously the cause of such sounds. The writer cannot, however, agree with Rosenbach that these sounds are to be heard only at the end of inspiration; they are probably most common near the end of inspiration, but they may be heard throughout inspiration, and not infrequently are heard during both phases. During all these examinations the men breathed through the mouth. Therefore, the nasopharynx was eliminated as a possible source of extraneous sounds.

The dull, sticky, inspiratory shower of râles is such a constant finding at some stage of early tuberculosis, that an examiner is very apt to consider a man who shows such signs, even with nothing else, as tuberculous. However, the greater relative frequency at the apices of normal muscle sounds, which may almost exactly simulate true râles, indicates that every method which will tend to differentiate the two types of sounds should be employed before a diagnosis is made.

SUMMARY

1. In the examination of 819 soldiers, 33 instances of joint crepitation were noted. Such crepitations often simulate true râles, but may usually be caused to disappear by simple expedients.

2. Twenty-three instances of transient apical crackles were found among the same men. Such sounds probably originate in the neck muscles. Marginal lung sounds or "atelectatic" râles were not noted above the clavicles.

3. Seventeen men (2.07 per cent) presented persistent apical adventitious sounds, which were often extremely difficult to distinguish from râles. They are probably unusually common in muscular young men, and constitute the most difficult problem in the diagnosis of early apical tuberculosis by physical examination. These sounds undoubtedly originate in the neck muscles, tendons or fascia. They can usually be caused to disappear or diminish by changing the position of the head.

EDITORIAL

THE STORY OF THE THREE TABLETS

Listen to the enthralling story of three memorial tablets.

1. On the wall of the library of the Naval Medical School is a bronze tablet. The inscription closes with the eloquent and thrilling motto, "Duty Stronger than Love of Life." What is the story of which this is the flower and the epitome?[1]

On June 12, 1881, the Arctic exploring steamer *Jeannette*, after drifting hopelessly for twenty-one months in the grip of the relentless ice-pack, was crushed by the ice off the bleak shore of Siberia. The leader of the expedition was Lieutenant Commander George W. DeLong. The medical officer was Passed Assistant Surgeon James Markham Ambler. Both were officers of the United States Navy.

On June 17, the officers and crew, thirty-three in all, began their perilous retreat over ice and water and land, dragging three boats and five sleds weighing respectively from 2,300 to 6,000 pounds. Often they had to traverse 13 miles to drag the whole outfit only one mile. In a gale the cutter in which were DeLong and Ambler with twelve others became separated from the other two boats and on September 17 reached land, with provisions for just six days! Had they known it, only 25 miles away was a village and safety, but alas, it was not shown on any map! Oh, the pity of it!

Occasionally a little game was obtained, but finally matters grew so desperate that on October 9, when the only food left was 2 ounces of alcohol per man, two of the party, at Ambler's suggestion, were sent ahead in the forlorn hope of finding succor. On October 22, when these two in turn were too weak to travel farther, a wandering native found and rescued them.

The other twelve crawled on steadily, losing one after another from death by starvation until on October 30 DeLong, Ambler and the Chinese cook alone were left alive. These three "struggled along a few hundred yards farther and laid themselves down on the snow for the last time."

On March 23, 1882, Chief Engineer (later Admiral) George W.

[1] This incident particularly interests me as I knew Admiral Melville for a number of years, especially in the American Philosophical Society. I seem to have been favored in knowing Polar explorers, for Dr. Elisha Kent Kane, another of the Medical Corps of our Navy, one of the early Arctic explorers, was a fellow-townsman in whose exploits, as a young lad, I felt a pride though I never knew him personally. I well remember with what avidity I devoured his book.

During the Civil War for some months under Dr. Kane's surgeon and successor in Arctic adventure, Dr. Isaac I. Hayes, I served as the Assistant Executive Officer, while Hayes was the Surgeon-in-Chief at the Satterlee Hospital and the lateJohn S. Billings was the Executive Officer.

Admiral Peary, again of our own Navy, has long been a friend and was once a surgical patient. Sir Ernest Shackleton I have met repeatedly in Edinburgh and in this country. I have also met Amundsen. Happily I escaped meeting Dr. Cook.

Melville, also of our Navy, who with the whaleboat party had found help, after long search discovered their bodies frozen by the cruel ice which then, having sated its vengeance, seemed to relent and preserved them for reverent burial at home.

The commander, DeLong, had offered Ambler the chance of life by being one of the two sent ahead, but in his pathetic and noble journal he says, "I thought my duty required me with him and the main body for the present!" "Duty" was indeed "stronger than love of life."

"Certainly," says Medical Director Gatewood, "that party never lost its trust in God. While perishing there was divine service. Day by day trembling lips uttered the Creed and the Lord's Prayer." Discipline was maintained. Personal as well as official rights were recognized. The strong helped the weak. "There was never even a disregard for the proprieties!" They were American gentlemen, members of that corps of the United States Navy which knows not only how to live but how to die. Even the Chinese cook was worthy of equal praise and honor.

2. In the Johns Hopkins Hospital is another bronze tablet to the memory of Jesse W. Lazear, Acting Assistant Surgeon in our Corps in the United States Army, one of the Yellow Fever Commission, who died of yellow fever contracted in the line of duty. The fine inscription written by President Eliot reads as follows:

WITH MORE THAN THE COURAGE AND DEVOTION OF THE SOLDIER HE RISKED AND LOST HIS LIFE TO SHOW HOW A FEARFUL PESTILENCE IS COMMUNICATED AND HOW ITS RAVAGES MAY BE PREVENTED.

He knew well the risk he ran, for the way in which yellow fever was transmitted, though then unproved, was suspected. He, a non-immune, undertook the especially dangerous work with the mosquitos themselves. Like Ricketts he accepted the challenge of death and lost. No! No! Not so! They both *won* Immortal Life! Happily there was no suffering of months in Lazear's case. The disease—yellow fever—laid its heavy hand upon him, and his noble, gentle spirit soon took its flight to the bosom of God and rests there forever.

3. In far-away Ecuador in the outskirts of Guayaquil, you will find the third tablet no less inspiring than the other two. It records the heroic conduct of Passed Assistant Surgeon William M. Wightman of the Public Health Service, who died of yellow fever on May 16, 1909. It is of enduring bronze—"*aere perennius*"—and was erected by his appreciative fellow officers of the Public Health Service to commemorate his sacrifice to duty.

In the absence of Surgeon General Blue, Acting Surgeon General A. H. Glennon writes the brief but pathetic story of his illness. "Although suffering from an attack of dysentery, he persisted in staying

at his post. On the evening of May 11, he had the chill which marks the onset of yellow fever, but knowing that his immediate superior was out of town, he got up to conduct the preventive measures for which he was detailed to Ecuador. When he was finally forced to give up, the disease ran a short period and terminated fatally."

Far from country and friends, faithful to the duty entrusted to him, faithful even unto death this simple record, brief but eloquent, reads as follows:

"WILLIAM M. WIGHTMAN, PASSED ASSISTANT SURGEON,
U S. PUBLIC HEALTH AND MARINE HOSPITAL SERVICE
MAY 18, 1857—MAY 16, 1909.

"GREATER LOVE HATH NO MAN THAN THIS THAT HE
LAY DOWN HIS LIFE FOR HIS FRIEND."

God grant that we, of these three noble associated medical services, especially in these terrible yet noble days of a war for world freedom, for Civilization over Barbarism, for right over brutal might may be enabled to equal these three men in the splendor of their devotion to their corps, to their country and to humanity.

When the editor of THE MILITARY SURGEON asked me to write a few words addressed especially to the young medical men now flocking by thousands to the help of our dear country, men who are necessarily ignorant of the traditions and examples of the three Government Medical Services, I first intended to give a brief résumé of the scientific services of the three corps.

In the Army I would have recalled the name of William Shippen, who during the Revolutionary War anticipated the celebrated "Flying Ambulance" of Larrey; the work of the first physiologist in America, Beaumont, and his patience and generosity, as well as his professional skill with his unruly patient, Alexis St. Martin; of the splendid scientific work done by Weir Mitchell and many others during the Civil War; of Letterman, my old chief in the Army of the Potomac; the bacteriological work of Sternberg; the splendid record of Hoff in stamping out smallpox in Porto Rico; the yellow fever services of Reed and his colleagues in Cuba and of Gorgas in Panama, the typhoid work of F. F. Russell, and many other achievements in the Army.

In the Navy I had in mind to relate the heroic death of William Longshaw, whose gallantry was twice recounted on the deck of sixty ships of war. He was killed in the assault on Fort Fisher, January 15, 1865, while binding up the wounds of a dying comrade. Their dead bodies were found lying side by side the next morning.

I had in mind also to relate the fine scientific work of Rixey, Gibson, Bell, Gatewood, Stitt, Beyer, Braisted, and others.

In the Public Health Service, I would have shown how the health of the whole nation and especially our protection from the ravages aforetime of yellow fever and still of smallpox (for shame) and of cholera, plague, and typhus; of the confident audacity of Waterhouse, Professor at Harvard and at Brown, and Surgeon in Charge of our very first U. S. Marine Hospital at Boston, Mass. (only two months after Jenner's announcement of the efficiency of vaccination he obtained the virus from England, vaccinated his own children and then exposed them to infection without harm); of their life-saving researches in typhoid, hookworm disease, measles, pellagra and rocky mountain spotted fever; fearlessly facing death, deliberately selecting the places where disease was *most* ruthless. Some of them are known by reason of valuable researches, many of them are the silent faithful modest heroes known only to the Recording Angel who has writ their names high in the roll of fame.

But Col. C. C. McCulloch has done this far more completely and authoritatively than I could do it for the Army. The scientific achievements of the Navy and of the Public Health Service await a similar historian. I hope before long to see such histories published in The Military Surgeon. They would foster an *esprit de corps* which would thrill all men new to the services and maket hem proud to wear the uniform of their several corps.

This task is too large for a simple paper like this. I have, therefore, to be content with the touching "Story of the Three Tablets."

Meantime the Great War is telling anew the old unselfish devotion to duty of our predecessors in the sacrifices of our present heroes.

Never before have there been so many casualties in the medical services. In this war, surgeons, while presumably classed as "non-combatants," share danger equally with the line officers. And they are not a whit behind the latter in bravery and devotion.

My own first commission is dated July 1, 1861, as first lieutenant in the Massachusetts Fifth. I was sworn into the service of the United States on July 4, 1861, on the east front of the Capitol at Washington. After a long intermission in civil life, my present commission is dated April 11, 1917. As one of the oldest men in service it is a great joy to assure these thousands of younger men—and God bless them!—that they are joining services with a goodly heritage of glorious traditions. I am sure that they will never allow them to be tarnished.

W. W. Keen.

FIRST, FURTHEST AND BRAVEST

In our issue of June, 1917, we called attention to the fact that the Medical Department was already first at the front; anticipating that more belated branches of the service might later lay an unwarranted claim to such enviable priority, as proved to be the case. We showed that large numbers of medical officers, enlisted men of the Medical Department and nurses were serving with the English and French in Belgium and France long before there were any other American troops on foreign soil; and that they suffered the first wounds, and achieved the sad distinction of the first deaths, at the hands of the enemy. Our exposition of fact has just been confirmed officially by the Secretary of War, who, in his Report for 1917, says: "Indeed, the honor of first participation by Americans in this war belongs to the Medical Department."

Since then the record of the Medical Department has continued its priority of glory. It has its representation in Italy, and through its ambulance service it is the only branch of the Army flying the American flag on the battle lines of Macedonia. In its latest extension of its humanitarian frontier, a hundred medical officers are en route to Roumania for service.

Now comes the announcement that France has honored Ambulance Section No. 5, on duty with the French forces, with the first decoration for valor given any American military organization, the "fourragere." This rarely bestowed decoration, an aiguillette with a cord of the colors of the Croix du Guerre, is worn by all members of an organization twice cited in orders for extraordinary heroism.

The medical profession may well take pride in the fact that its representatives on the firing line have gone first, gone furthest, and been adjudged the bravest.

E. L. M.

"SMARTNESS"

Smartness is defined as the quality of being able to accomplish results quickly and efficiently; it has a peculiarly appropriate application to things military and especially to military personnel. A distinguished British officer recently defined it as the outward and visible sign of efficiency and illustrated his definition by the story of two regiments. One slouchy, unkempt, slow in executing orders, ill in drill and poor in marching; as he expressed it, "a rotten organization." The first tour of this regiment in the trenches resulted in its annihilation and serious danger to the whole line. The other regiment was "braced" to the limit, clean in person, dress and arms, quick to respond to every

order and on the *qui vive* for anything; the men were proud of themselves, proud of their organization and the army was proud of them. In its very first engagement, this regiment covered itself with glory and received the well-merited approbation of its fellows.

Just exactly what was the difference between these two regiments? What made one an honor to its country and the other a disgrace? That indescribable something which is called "Smartness."

The British officer, continuing his story, said: "In the beginnings of our national army it was thought that inconspicuosity was essential so we used dull trimmings and when, by chance, they were not dull, allowed them to become so with dirt. Dirty trimmings begat dirty shoes, dirty shoes dirty clothing and dirty clothing a dirty person. A soldier in this condition could not respect himself and one who does not respect himself can respect no body or thing."

The result was demoralization and the authorities perceived that by allowing departure from a "smart" appearance they distinctly threatened the efficiency of their army.

This, if we would but realize it, is an experience common to all walks of life. No one respects a tramp. Why? Because the tramp does not respect himself, how could he? So soon as he begins to respect himself, his value as a citizen increases and in due time he comes to respect the state.

"Smartness" is a quality particularly important to cultivate in the sanitary soldier. Our organization is necessarily a somewhat loose one, the character of its work demanding more or less independence on the part of the individual. For this reason alone it is essential that our discipline should be of the highest quality. The carrying of a rifle or the trundling of a gun is not the only essential to the making of a soldier. The carrying of a litter, in its way, is as important and demands of its bearer an intelligence, resourcefulness and courage quite equal to that of the arms bearer. It also demands a discipline of the strictest character.

In these days of great hospitals, requiring an immense personnel, the profession has developed a cast of hospital physicians that has learned the necessity for team play and consequent discipline. Many of this class are now in the service and fortunate it is for the army that they are; for through them the medical department will get the moral support necessary to the maintenance of the quality and training of its enlisted personnel.

We sometimes wonder just what this training now is. Is it uniform, "smart," rigid but not absolutely unbending? Is it just, though reasonably generous? Is it efficient?

The necessity for absolute uniformity of training admits of no argument. The Prussian army which, whatever its shortcomings, is accepted as the standard in military efficiency, insists upon uniformity to the ultimate degree. It does not demand geniuses, but a high average mediocrity and such training that, in any contingency, the problem would be solved practically in the same way by every officer and man, and so the result could be anticipated by all.

The advantages are obvious and, even now, we are sending detachments of line officers and men to the front to learn the game as it is taught there, so that when their organizations arrive on the ground they, in turn, can be taught. We have not, however, heard that any officers or men of sanitary troops are being sent for this purpose, though such there may be.

We have many thousands of sanitary soldiers scattered among our various camps; are we really making soldiers of them? Are they "smart" and well disciplined? Are their military appearance and manners unexceptionable? Are their equipment, transport, etc., kept up to the best field artillery standards, for example? Or do their ambulances run about covered with mud, tail boards down, dirty and disarranged inside, curtains flapping, animals ungroomed and harness awry, drivers and orderlies lolling about, smoking and looking anything but the soldiers they should? Do our officers insist upon attendance at roll call and drill of every possible man in their organization? Is the prescribed system of instruction carried out rigorously, or is "recall" sounded when the barest excuse offers? And finally, do the intelligent line officers of the camp acknowledge that the sanitary units are model military organizations? We have known such to happen in the old army, not too often to be sure, but no doubt it is happening much more frequently in our army of today.

Let us hope so, for if our officers and men are not disciplined and uniformly trained, if our organization is not "smart," if our hospitals are not maintained at the highest civil standards, if our ambulances and animals are not up to the best field artillery pattern, if our field hospitals cannot pitch in twenty minutes and strike in half that time, if our ambulance companies cannot break camp and get on the road in half an hour, in a word if we are not a military team, we are, by so much, lacking in efficiency and failing in our duty.

COMMENT AND CRITICISM

NEW USES FOR THE ARMY LITTER

The military hand litter, familiarly called "stretcher," is one of the most essential field appliances of the Medical Department. Its form is fixed by its uses and is only modified in non-essentials. That of our Army is among the best of its kind, combining lightness (22 pounds), strength, efficiency, and is complete in itself—a prerequisite in a field appliance. Anything that has separable parts is sure to lack some necessary part when most needed, for in the field it is easy to lose and hard to find, while replacement is often impossible.

It needs no argument to convince that the ideal hand litter is one that would meet every condition of service, so that the patient, after once being loaded upon it, would not necessarily have to leave it until finally transferred to a bed in a permanent hospital or even then. It follows from this that an army should have but one standard model of stretcher, and that all the instruction in bearer work with it should be based upon this model—exactly the same as is the Manual of Arms based upon one model of rifle.

To be sure no appliance can be universal. Circumstances will occasionally arise which will preclude the use of the standard litter, just as they will the use of the standard rifle, but this is no argument against the principle of standardization—and the rare exception only proves that there is a rule.

Maj. H. R. Allen, M. R. C., Director of the Camp Greenleaf School of Applied Surgical Mechanics, has worked out in an ingenious way the use of the regulation hand litter as a splint to meet, effectually on the field, all the indications for the treatment of any fracture, but especially of the extremities. We take pleasure in inviting attention to his modest exposition of his method and to the illustrations which so well show its technique.—*The Editor.*

"Among the numerous innovations at Camp Greenleaf there is one that will contribute both comfort and surgical aid to each of the million and more wounded soldiers every year, whose wounds are so serious that they must be transported upon a litter. This innovation costs nothing since it neither adds to nor subtracts from the army litter as it stands today and has stood for many years. Loading the stretcher requires but one man. It is literally a one-man job, and he can crawl out on his belly to his patient and load him on the litter, exposing himself to the minimum of fire. It is obviously true that, ordinarily, two men are necessary to carry the loaded litter. It may be transported back

at any opportune time, but it must be remembered that the patient is comfortably immobilized and is actually under treatment although left alone out on the field. The soldier is loaded on the stretcher by first tieing the foot on the injured side to the front end of the litter with the litter sling. The sling from the rear end of the litter is passed over the shoulder down behind the soldier's back and is brought up between his thighs. Then the soldier's belt is used to elongate the rear sling by passing it through the handle loop and buckling it around the rear handle of the litter. It is buckled just tight enough to make the pelvis tilt up on the sling side, as far as its anatomical range will permit. The patient and the litter together are gently turned until the loaded litter rests on its feet right side up, and the patient upon it, comfortably immobilized, is actually under treatment, so far as injuries to the legs or thighs are concerned.

"Immobilization by the use of fixation forces for fixation purposes is the platform upon which all successful fracture work rests. It should be noted that the patient is loaded without being unduly handled or carried to the litter and no splints are required, no grass, or weeds, or sticks are used, nor is one crooked leg tied to another crooked leg as a substitute for a splint. There are many splinted patients in hospitals today who would do infinitely better if treated on an army stretcher, made up like a bed, with an 8-inch hole cut through the canvas for daily bed-pan service. This 8-inch hole for bed-pan service eliminates the excruciating pain endured by the patient every time he is lifted on the bed pan. By this method the patient and the litter are one and his injuries are not disturbed in any way by lifting on the litter to put the bed pan in place and remove it.

"Fractures or shell wounds of the arms, forearms, legs, thighs, trunk, neck or head are immobilized and transported by the employment of suitable fixation forces for fixation purposes. Pads under the points of attachment and possible pressure are readily applied as indicated.

"Pain from fractures is chiefly due to the prodding of soft, sensitive tissues by sharp jagged bone fragments; but if the bones are pulled down to their normal positions and fixed there by fixation forces, then there can be no prodding. By this means the chief element in the production of pain is instantly eliminated. In this connection there is another feature that is even more important than the elimination of pain, and that is the elimination of the possibility of additional damage due to the prodding ends of the bones grinding against each other, or lacerating the soft tissues. Lacerated tissues (hard or soft) are known to be excellent incubators for serious infections.

Tying the Foot of the Injured Side with the Left Front Litter Sling.
Patient and litter turned on left side.

Passing Right Rear Sling in Front of Right Shoulder, Down Back of the Pelvis and Forward through Crotch.

Tilting Pelvis by Traction on Rear Sling.

(To face page 74.)

Turning Litter to the "Lower" with Patient on It.

The Litter "Loaded."

Removing Patient's Waist Belt.

The Rear Sling Elongated by the Waist Belt, Which Is Passed Through Loop of Sling and Buckled Around the Rear Handle of the Litter on Uninjured Side.

Tilting Litter to Left to Illustrate Efficiency of Immobilization of Patient.

Tilting Litter to Right.

Litter Approaching Vertical, Head of Patient Up.

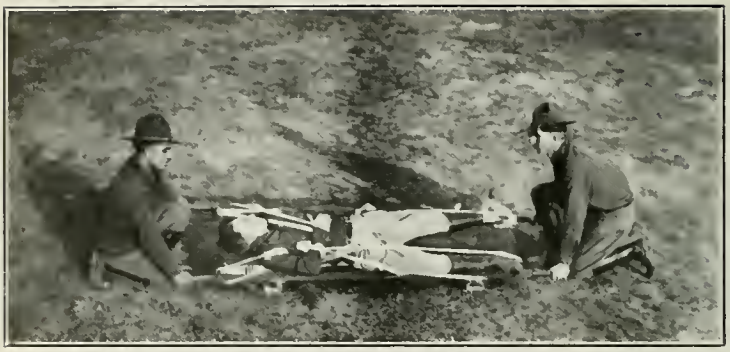
Litter Approaching Vertical, Feet of Patient Up.

One Bearer Carrying Loaded Litter on His Back. Patient Completely Immorilized.

Loaded Litter Turned Bottom up, Immobilization Maintained.

Litter Passing Vertical, Feet of Patient Up.

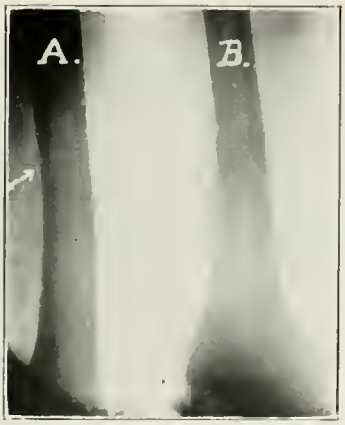
Patient Completely Inverted, the Fractures Remaining Immobilized.



Fractures of Right Arm and Thigh, Left Forearm and Leg.

Complete Immobilization, All Extremities Broken.

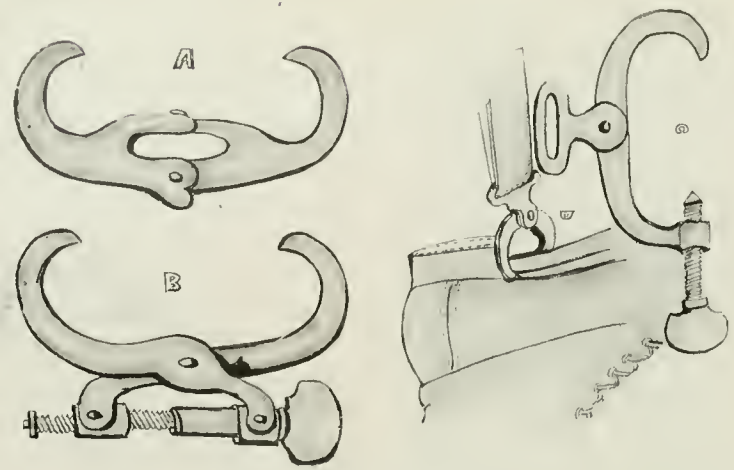
Immobilization Maintained Even Though Litter Be Carried by Handles of One Side.



Efficiency of the Method as Shown by X-Ray, after Transporting Patient over 50 Miles in an Ambulance.

Eight-inch Aperture in Canvas for Bed-pan Service.

Two Men Immobilized on the Same Litter.



Different Types of Allen's Shoe Cleats.

Demonstrating the Efficiency of the Allen Shoe Cleat, as Well as of the Army Shoe and Belt.

"That these fixation forces produce effective immobilization may be inferred from the accompanying illustrations, and proved by asking a patient so treated. But if one really wants to know what a straight jacket actually feels like, then have some one immobolize him on a litter by the Allen method. I have tried it myself and have observed two very interesting results. First immobilization is certainly present in very large quantities, and second, the complete absence from pain or discomfort is surprising. The reason for the absence of pain is the absence of traction. Traction is not constant; it is only present when the litter is markedly tilted or when the muscles contract, but since the muscle contractions are blocked by adequated fixation forces, they are deprived of their normal attribute of producing motion. The explanation is simple enough when you stop to think about it.

"The patient can be carried with either end of the litter raised, making it possible to remove wounded soldiers out of deep dugouts, or transport them around the sharp, narrow angles of the trenches.

"All of this can be done without altering the army litter, but if a soldier has both arms and legs fractured, or is badly torn by shell fragments, or crazed by poison gases or other causes, then additional dressings and retention straps would be required. With little expense these padded straps and sole cleats, and the 8-inch hole in the canvas, can be supplied making the U. S. litter a universal instrument for loading, transporting and treating wounded soldiers.

"As an apparatus for hospital treatment it is only fair to say that its hospital record is in no sense inferior to its qualities as a means of transportation. The limited allotment of space prevents narrating the great variety of cases more appropriate to litter treatment than to any other single device. The many appliances now in use can be employed better with the stretcher than without it but that opens up another chapter much more elaborate than that already presented."

DISPOSAL OF EXCRETA IN THE TRENCHES

Our veteran colleague, Dr. Simon Baruch, sanitary soldier and civil hygienist, a lover of humanity whom "age cannot wither or custom stale his infinite variety," has honored THE MILITARY SURGEON with some suggestions regarding disposal of excreta under the peculiar conditions of warfare on the western front, which we take pleasure in presenting.

Life in the trenches is primitive and there, perhaps, men come closer to nature than anywhere—they are literally cave-dwellers. Moreover, in their simple life they are actually demonstrating every minute the struggle for existence and the survival of the fittest.

To help our side to survive we would give the best possible of our brains, experience and substance, a best which will be the outcome of the combined effort of the nation and to which our colleague would contribute whole-heartedly.

The matter of trench conservancy, in its last analysis, seems quite simple, a bucket, a man to carry it and a convenient place to empty it. But there is hardly anything more important to the health of the command than this very matter. Shall our trench dweller sit or squat over the bucket? If he sits he becomes a host to lice, if he squats he takes the posture nature indicates, and avoids infection. What form shall the bucket take and the seat, how many will be necessary, and where shall we get them? Should the urine as well as feces, be removed from the trenches? Shall deodorants be used—flies excluded, etc.? What about toilet paper and clean hands, are these possible?

Dr. Baruch submits and defends the following propositions supporting his plan of disposal:

1. That separation of the liquid from the solid excreta may be easily accomplished without resorting to the unnatural procedure now practiced.

2. That for the practically dry solid excreta deodorization before removal from the bomb-proof is sufficient for all practical purposes.

3. That no bulky deodorant or disinfectant should be added, because—

4. The capacity of the can or bucket should be utilized to the utmost to save time, labor, and exposure to the enemy's fire.

5. Any large tins at hand may be used in lieu of buckets, and

6. The boxes and seats here designed may be shipped in "knock-down" form, and the buckets in nests. They appear to me as important as other supplies.

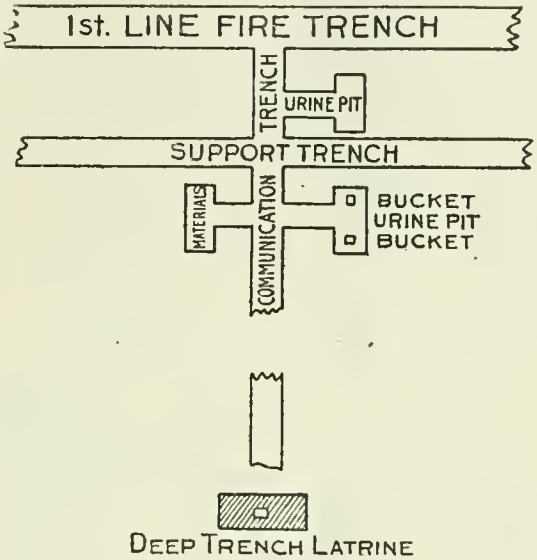
"The disposal of excreta in the trenches has been briefly but clearly described in Colonel McCulloch's article in the *Journal of the American Medical Association*, July 14 and 21, 1917. It is again referred to in the October number of THE MILITARY SURGEON by Col. Thomas H. Goodwin, of the Royal British Medical Service. I have published a brief article on the subject in the first named journal. Since the latter was written I have had a personal interview with Captain Gilmour, of the British Royal Medical Service, in the Surgeon General's office, who confirms the correctness of the subjoined diagram (Fig. 1).

"Taking these views and descriptions as a basis I would discuss the following points.

"1. In the bomb-proof shown in the diagram two urine soakage pits are placed alternately with two buckets.

"2. It is expected that the urine be passed into a separate bucket or into a trough leading into the urine soakage pit before defecation.

"3. That the bucket (of about 8 gallons capacity) is removed when two-thirds full, about one-fourth of the contents being cresol solution and sawdust, replaced by another and then taken by hand to the disposal pits in rear of the trenches. In the diagram this distance is about 1,200 yards.



SANITARY ARRANGEMENTS IN THE TRENCHES.
Fig. 1.

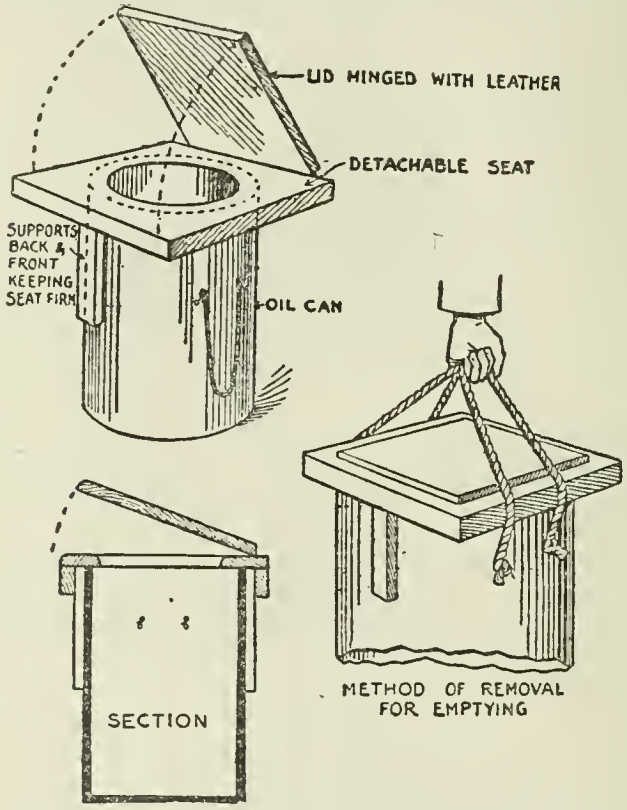
"4. That the bucket when so removed remains covered with the wooden seat and cover (Fig. 2).

"5. That the bucket is thoroughly cleaned and washed before it is returned to the bomb-proof.

"I have devised the following described bucket to be used in lieu of urination into a separate bucket, prior to defecation.[1] The bucket,

[1] *Journal of the American Medical Association*, November 17, 1917.

12½ inches deep and 13 inches in diameter, of about 6½ gallons capacity, is made entirely of metal and provided with a seat of the usual style with a self-closing lid (Fig. 3). The diagram shows that the solid excreta are received in a separate smaller bucket which is hinged in a groove cut in the upper posterior rim of the outer bucket. This arrange-



IMPROVISED LATRINE BUCKET.
Fig. 2.

ment provides for the reception of 40 pounds of liquid and 8 pounds of solid excreta. Only 14 individuals could be accommodated with this arrangement, which is intended for temporary use during the rapid construction of the trenches. Doubtless, the Sanitary Corps would arrange for these buckets when cooperating with the trench builders.

"With reference to the second proposition; this is an unnatural procedure that results in incomplete emptying of the bladder. Consequently, more urine is passed during defecation. When the trench

is being supplied with the urine soakage pit described in Colonel McCulloch's (Fig. 1), I would suggest enlarging the pit *A* and placing the buckets as indicated in Fig. 1.

"In order that the individual be enabled to direct the urine into the pit during defecation, I have devised the bucket (Fig. 4), which is provided with a septum about 3 inches from its anterior wall, beginning 4 inches below the seat and terminating in a 1½ inch tube. A soldered coarse wire sieve below the upper rim would prevent paper, etc., from entering the funnel. The tube is intended to be inserted into a larger tube projecting from the urine soakage pit, as is shown in Fig. 4. This bucket will serve nearly 100 men without renewal. For removal, the entire bucket is taken to the disposal pit.

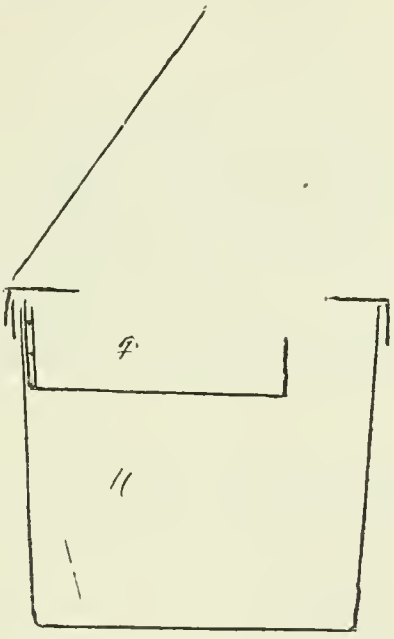


FIG. 3.

"As to the third and fourth proposition, as now used, this device would provide for only about 50 men because the bucket is removed when two-thirds full. If the feces were more dry and other fly-protection provided the bucket would contain more dejecta and less deodorant, making it unnecessary to carry by hand to the disposal pit a partly filled bucket, together with the wooden fly-proof seat. I suggest in view of the fact that the excreta in my device will be less fluid, that the size of the bucket be reduced one-quarter. An ordinary metal cover, similar to that of a garbage can, would afford protection against flies and

would certainly be more easily cleaned. The advantage is obvious, as is also an iron handle to take the place of the rope. The bucket is about 13 inches in diameter and 12½ inches deep, with a capacity of 6½ gallons.

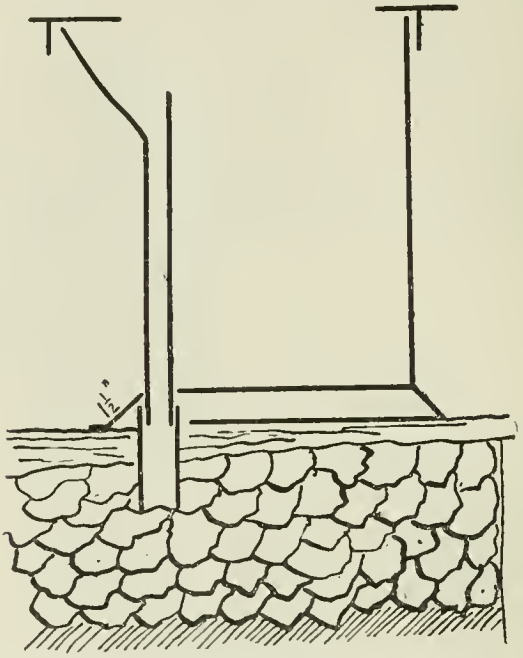


FIG. 4.

"When the trench is more permanently established the following device may prove of practical value: A separate urinal is constructed

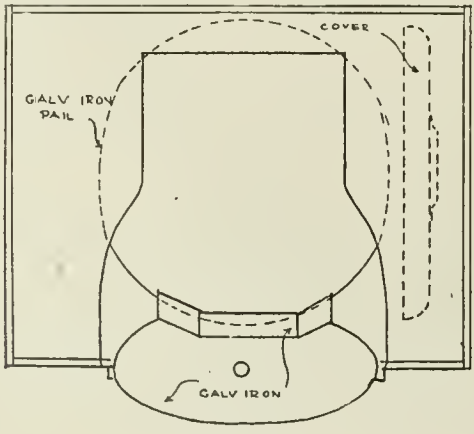
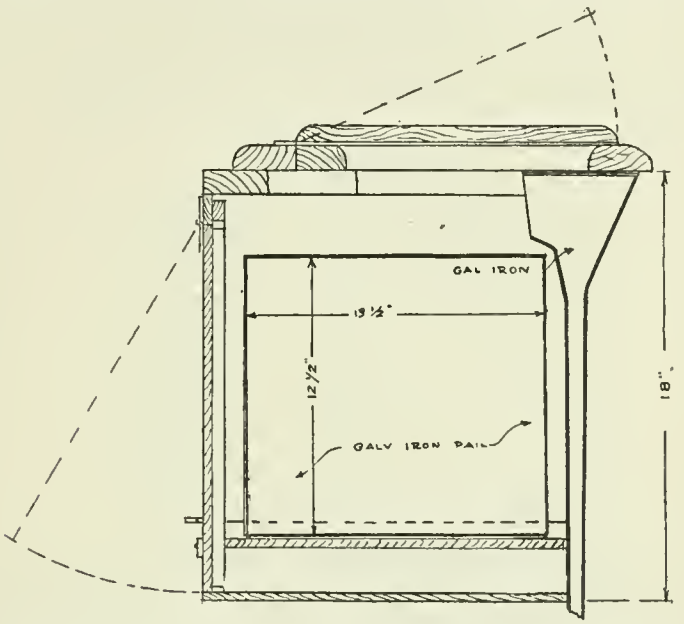


FIG. 5.

(Fig. 5) and secured to a fly-proof box with seat and self-closing cover. Beginning at a distance of 4 inches below the seat on the posterior wall, the urinal is supplied with a flange of 1 inch, which is turned backward and upwards at a slight angle. A strong wire is hooked securely to this flange, and fastened posteriorly to the lowest point of the upper portion of the box for the purpose of diverting excreta from the center, where they are apt to accumulate in a pyramid. A bucket of a capacity of 6½ gallons is snugly placed against the posterior wall of the urinal, beneath the flange, and held in position by strips of wood on the floor of the box. A door, 15 inches high, occupying the entire width of the box, is secured by hinges to the upper part of the posterior wall of the



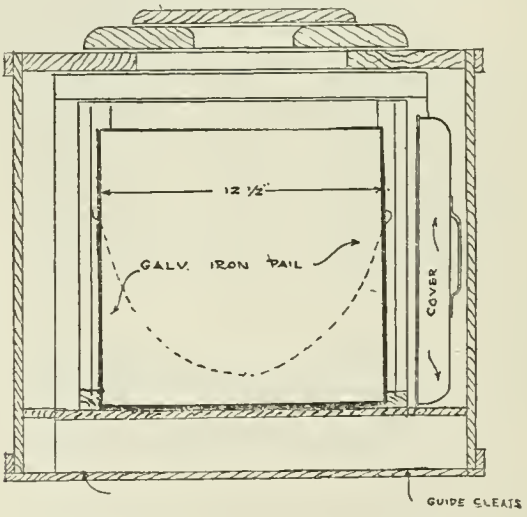
box, and is provided with a cleat 2 inches above its lower edge on the inside, so that when it is closed these cleats hold the bucket in position. A handle for lifting the door and knobs for securing it closed are provided. The iron cover is placed alongside the bucket within the box, before closure. As shown in Fig. 5, when the seat is properly adapted, the urine cannot be directed into the bucket except by wilful design. In this manner solid excreta are received in the bucket, while the liquid flows into the urine soakage pit.

"This bucket is an ordinary 6½-gallon garbage pail, which, differing from the garbage can, may be 'nested' for transportation. For removal the posterior self-closing door is lifted, the cover is slipped over

the bucket, and a fresh bucket is inserted in its stead. The full bucket is now carried to the disposal pit, emptied and cleaned.

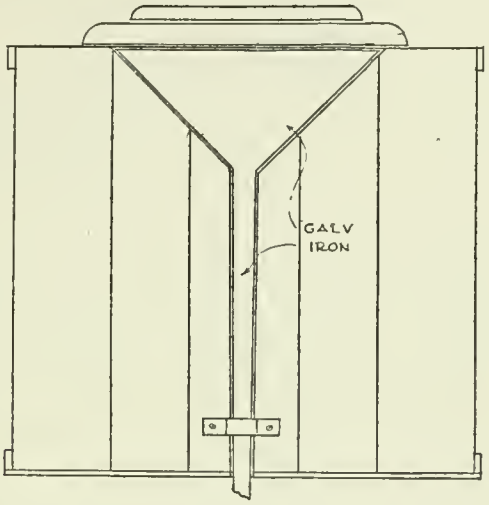
"The advantage of this plan is that it would have a much larger capacity than that above described. The seat may be of wood, but it could be readily constructed of galvanized iron. Objection has been made that the iron seat would be cold. Since the larger front portion of the seat may be covered by the trousers, it would appear that this inconvenience would be infinitesimal when compared to the others our soldiers have to suffer. The iron seat and cover would not weigh more than a good hard wood cover.

"The solid excreta average 4½ ounces daily. The bucket here figured would easily receive 40 pounds of solid excreta, which is as much as a strong man may conveniently carry for a distance. This arrangement would, therefore, provide accommodation for about one hundred and fifty men, if no urine or other liquid is added.



"Disinfection would, it seems, be most effectively practiced at the disposal pit, thus saving the carriage to and fro of the disinfectant. It remains, therefore, chiefly to provide against flies and odor. The latter may be accomplished by the old-fashioned nursery process of smoking paper whenever the odor becomes annoying to men whose olfactories have become inured to naphthalene, sulphur, iodoform, etc. Contamination of flies would perhaps be best avoided by care in handling the bucket and by sprinkling with cresol solution, which Colonel Goodwin, R. A. M. C. informs me is his practice.

"The object of my device is to obtain accommodation for the largest number possible, to avoid the necessity for frequently carrying the bucket by hand for long distances, and for frequent exposure to the enemy's fire part of the way. For this reason I venture to suggest the omission of bulky disinfectants and deodorants. Pulverized copperas, chloride of lime, and others will naturally present themselves as cheap, easily applied, and efficient. Among the advantages of the iron seat and cover is its indestructibility. Captain Gilmour, of the Royal British Medical Service, has informed me that the men are often forced to use the wooden boxes for fuel in very cold weather.



"It occurs to me that the unpleasant and unwholesome cleaning of the buckets after being emptied could be greatly improved by using paper containers. I have experimented with the latter, and have found the ice cream paper bucket to hold water for 14 hours, but it is clumsy because made of one piece, and is not round. I believe that a cheap stiff paper tube 12¼ inches deep, and of the same diameter, snugly fitted to the inside of the bucket, and a cardboard bottom would suffice to prevent adhesion of excreta to the sides of the bucket. The bottom may be placed in first. On one side of the box there is provision for storing such paper linings when properly packed. Their use would be compensated a thousand fold by saving wear of the bucket and time and labor. As the British method provides toilet paper and our own regulations require its use, my suggestion may not be regarded as unwarranted for the rough usage of trench sanitation, indeed for

camps also that are not provided with sewers, these devices appear to be well adapted. The latrine could be arranged over long urine soakage pits. The buckets or boxes receiving solid excreta could be supplied with stiff paper lining, and they could be quickly conveyed on wagons to the disposal pit or incinerators, and returned clean."

THE ARMY METHOD OF VACCINATION

For many years Army regulations have prescribed in detail exactly how the operation of vaccination shall be done, and this method has varied but little. The principle of multiple incisions is insisted upon, at least two being required. After detailing the manner of preparing the skin, the essential of which is washing with warm water followed by alcohol, the regulation proceeds:

Incision is the method of choice and it should be made with the point of a sterile needle, producing a "scratch." A sterile scalpel may be used, but is more likely to cause bleeding. The incision or scratch should preferably not draw blood. There should be at least two incisions, three-quarters of an inch long and one inch apart; after exposure to smallpox four incisions will be made. The virus is then placed upon the abraded surface and gently rubbed in, unnecessary irritation being avoided.

The wound is allowed to dry thoroughly and can be left without dressing, though several layers of gauze may be applied with adhesive plaster. Any dressing that retains heat and moisture is bad. Shields will no longer be issued.

Capt. E. L. DeLanney, M. R. C., has prepared for THE MILITARY SURGEON a very timely article in which he reports the results in 520 cases vaccinated by the endermic method. His review follows.—*Editor.*

"I have maintained for a number of years that the American method of vaccination was defective in its technique because of the variety of local results, some of which are very severe. Nor could they all be due to individual susceptibility, because bad arms often occurred in those previously vaccinated, neither could they be blamed to the operator because, no matter how careful he was, bad arms were sure to follow. Shields and protectors were often to blame, but bad arms would occur where nothing in the way of protection had been used. What, then, was the cause of those large, sloughing, painful sores with their necrotic cores and sharply defined edges, which later filled up with redundant granulation and still later became glazed over, instead of covered with normal epthelium?

"During a smallpox epidemic, I had, as city physician to an industrial city, to have about 4,000 laborers vaccinated. The best virus procurable was used and the strictest precaution was practiced, but, in spite of all, a large number of very sore arms developed, with

resultant suffering and loss of time to laboring men who could least afford it.

"It was noticed that a large number of men of foreign birth had well-formed scars on their arms, and it was learned from them that they nearly all had been vaccinated from scabs removed from another person's arm, as is still the practice in some communities. It was also noticed that when 'scab vaccination' had been used, a larger number of places on the arms had been vaccinated, often as many as five or six to each arm. The question then came up: Does not the number of vaccination incisions play an important part in determining the severity of the local reaction? Following these observations I then proceeded to experiment with multiple vaccination, but the epidemic having been controlled and nearly every one being vaccinated, no large number of unvaccinated could be gotten together for vaccination, observation and tabulation of results; but from the few that we were able to observe it seemed that the reaction was very much less severe, and that fewer sore arms resulted from the multiple vaccination than in the single ones.

"During the mobilization of the National Guard in 1916, I tried again to confirm what had then become a conviction, but the hurry, incident to rapid mobilization, did not permit of statistical report.

"In the February 10, 1917, *British Medical Journal*, Capt. H. W. Hill, D. P. H., described a method of vaccination by the subdermal method, and an opportunity to try it out came when 520 truck company personnel came to Fort Crook, to be eqnipped and prepared for over-sea service. I then had an opportunity to try out the speed with which this method could be used, an essential point when a large number has to be vaccinated, also the percentage of primary and secondary 'takes' and the results, both local and systemic. These results are tabnlated below, and justified statistically our previous conviction, that multiple affords far less local reaction than single vaccination and that the defusion of the area of inflammatory reaction prevents local death of tissue.

No. of men vaccinated	Not previously vaccinated	Previously vaccinated
508	116	387
Successful	99	109
Unsuccessful	17	278
Had smallpox	3	2
Successful, per cent	85	28
Unsuccessful, per cent	15	72
No. of dressings required	1	0

"The time actually consumed in vaccinating each man was about fifteen seconds, there was no time lost in waiting for arms to dry, no after treatment and in no case was any man excused from duty for more than three days. The method was practically that described by Hill, which I here copy:

"(1) The sleeve is rolled up. (2) Orderly 1 washes the arm with soap and water. (3) Orderly 2 washes the arm with rectified spirit. (4) Orderly 3 washes the arm with ether. (5) Orderly 4 breaks the capillary tube of glycerinized vaccine, and sets the rubber bulb or other method of expelling contents, handing it to orderly 5. (6) Orderly 5 expels the vaccine at three or four points on the arm in a triangle or square having not less than 2 inches between the points. (7) Orderly 6 sterilizes an ordinary sewing needle, and hands it to the medical officer. (8) Medical officer punctures the arm through the drops of vaccine; six tiny punctures, drawing no blood, are made through each drop, each set of six occupying a space of not more than 1/6-inch square; the needle is held almost parallel to the surface; not over 1/1000 of an inch enters the epithelial layer, a peculiar little 'snick' being felt as the needle goes in. (9) Orderly 7 wipes the vaccine. (10) The sleeve is pulled down."

"The only difference in the technique I used was, that all the needles were mounted on a handle, either a hemostat or pushed into penholders, to facilitate handling. This was found a great help, for when the needle was held in the fingers alone they became very tired, and the needle hard to hold.

"Of the 508 men vaccinated not one had a bad arm. There was redness, and swelling differing in degree with each case, but no suppuration or large scabs or large area of necrosis. One case had to be dressed once because of multipustular vaccinia around the points of vaccination. These pustules resembled confluent smallpox, and covered the outer surface of about half the arm, but they soon dried without bad results. In previously vaccinated cases a typical local reaction resembling a von Pirquet reaction appeared at the side of puncture, usually accompanied by itching which subsided in a few hours; this was not an indication that the vaccination was or was not going to 'take.'

"That which is hard to explain is the great variation in the number of successful points of vaccination in different arms; in some cases all four took, in others three, two or one—this in both primary and secondary cases. It was noticed, however, that the relative number increased in the unvaccinated, while in those with only one 'take' it was always a very weak 'pock,' with very little systemic reaction as though the individual had a relative high degree of immunity.

"The vaccinial 'pocks' were typically umbilicated, and dried up in 15 to 20 days in the form of hard black buttons, which readily dropped

off, leaving a typically vaccinial scar. The accompanying photographs taken on the tenth day after vaccination, when the arms were checked up for results, shows the different types of 'takes.'

"It would seem from observation of this series that the method described by Hill has many advantages: (1) it protects the arm from external infection, for as soon as the arm is wiped off the punctures are practically sealed; this also obviates the necessity of waiting for the arm to dry or to be dressed. (2) The numerous vaccination points diffuse the area of inflammation over a large surface, thus preventing the formation of a necrotic center, as in the single method, at the same time increasing the percentage of 'takes.' (3) It is painless and bloodless. (4) It is rapid enough for any requirement. The saving in suffering, time, bandages, and dressing by this method will be appreciated by those who have had an opportunity to compare this with other methods now used, or who have had to spend whole mornings dressing suppurating arms."

CONSERVATION OF GREASE

No part of the many functions of the company commander is more important than the intelligent supervision of the company mess. It is an axiom among soldiers who know, that a well-fed and a well-worked company is a happy, efficient organization. If the men are overfed and underworked they suffer from repletion; if overworked and underfed, from depletion; both conditions promote inefficiency. This statement can be verified in any regiment, the best companies of which are inevitably those in which the training and feeding are intelligently balanced.

But a company mess does not run itself, nor does the cook or even the mess-sergeant determine its character; it is the company commander, and the value of the mess will be directly proportionate to his interest in it. We hope that the boards now investigating the efficiency of officers will give some regard to this question from the standpoint of the company mess.

Apropos to kitchen economy, First Lieut. George E. Barksdale, M.R.C., U. S. A., has favored THE MILITARY SURGEON with his views regarding the conservation of fats by military organizations, which conservation is important from several angles. He writes:

Soon after my assignment to duty at ——— as sanitary inspector of the ——— camps, I was forcibly impressed by the waste that was noticeable in camp and barracks kitchens, and the apparently inexcusable way in which not only meats but fats, bread and vegetables were thrown into garbage cans to become a burden in the way of disposal and, even if sold, to bring to the company

fund a mere fraction of what the material cost or was actually worth as food or soap.

I realize it is no easy or grateful task to attempt to teach the average civilian or rookie cook even the fundamental principles of kitchen economy; still if we hold aloof from approaching a disagreeable duty, because it appears to be merely a more or less immaterial detail, the waste will continue and much good food will be lost. Even rejected fats profit no one under present conditions.

Upon inquiry at one of the mess kitchens, I found that three pounds of soap daily per hundred men are used for dishwashing. This of course does not include the amount used by the men for lavatory or laundry purposes which is as much again. As the price of common soap is eight cents a pound at present, this means an outlay by an organization of one hundred men of 24 cents a day for kitchen soap. As we have over a million under arms we are, accordingly, paying $2,400 a day for soap for kitchens alone. In the meantime, the waste fat from these kitchens becomes a question of disposal and amounts to enough in a single day, in many instances, to produce sufficient soap to last the kitchens a week.

If means were adopted to save this single item of waste fats, not only would such result in disposing of one of the most annoying of all camp wastes, but would serve, as well, as a really important source of fat, which is becoming scarcer as the war progresses.

All good housewives save "drippings" for various culinary purposes and soldiers could at least make soap from the fat they now so recklessly waste. This is easy to do and the method suggested would effectually produce soap that could answer all the purposes of camp life. I am not wedded to this method, others may be equally good or even better.

Upon inquiry at one of the camp kitchens I found I could secure as much grease as I needed. This had resulted from a surplus supply of tallow and hog fat obtained from boiled or baked meats which had, in this instance, been saved.

This was mixed in the following proportions: Five pounds of strained grease, obtained by melting the grease and straining it through a coarse cloth, was added to a solution of caustic soda (common lye) made by dissolving a pound in three gallons of water, limestone water will not do. This mixture was boiled slowly for two hours, occasionally stirring with a paddle, sufficient water being added from time to time to make up for the amount lost by evaporation. Towards the end of the process, small quantities of the mixture were mixed with water to ascertain if all of the oil was combined and if the mixture readily hardened upon cooling. Should there be too much oil for proper combination or the saponifying process be not completed, globules of fat would float on the admixed water. When such is the case the process must be continued until the soap is completed. If, after a reasonable time, globules of oil still appear, a small amount of solution of lye is added to completely saponify the excess of oil or fat present.

When all the fat had saponified and the water disappeared, the finished product was poured into a suitable flat vessel and put away to cool. In twenty-four hours it became sufficiently hardened to cut into suitable pieces for con-

venient handling and dividing. This was done by placing the soap on boards, each cake being separated about a quarter of an inch to allow air to permeate through the pile. When completely hardened it was very readily cut into bars of about a pound each, by using a dull knife.

The five pounds of grease yielded 16 pounds of soap when fresh, but it lost some of this weight in drying. The soap was ready for use the very day it was made but it is better to have it thoroughly dry before using.

In collecting the grease in camp, previous to making the soap, all meat skins, either from the mess room or kitchen, all uneaten portions of butter, oleo and fat of any kind, the scraps of meat left on plates, should be deposited in a vessel placed near the garbage can, so that the fat could be scraped into it as the man deposits his uneaten food in the garbage can. In this grease pail, which should be provided with a tight cover, is placed at least two gallons of water in which a pound of lye is dissolved. This solution slowly saponifies the grease and when the accummulated quantity is sufficient, the whole is gently heated and strained through a cloth or collander and the manufacture of soap continues. Of course a rough estimate of the amount present should be made in adding any more grease to be saponified by the lye. The object in using the lye solution is to obviate any likelihood of the grease becoming offensive by being kept. If there is an opportunity to render the fat from time to time and to discard the meat skins and other portions which cannot be used, the grease may be kept for a month or more with impunity, when it may be worked into soap in a few hours by one man.

The necessary utensils for utilizing the waste of fats as here suggested are, a six gallon boiler, a pail of four gallons to hold the fat and a common baking pan into which the finished soap may be poured to cool. The heat necessary to carry on the process may be had from the kitchen fire, the incinerator, or a camp kettle suspended over a fire.

This simple method if methodically carried out, I am quite sure will effect a very considerable saving, it will use that which is going to waste at present and at the same time lessen the amount of money the government now expends for soap, if not wholly abolishing this item of cost.

In former years few households bought soap except as a luxury, especially in the country, because the saved fat was used to make soap. Just what becomes of it at present is a question; perhaps it is thrown away or burned, wasted in a truly modern American way. We buy soap because we are not thrifty enough to make it.

CURRENT LITERATURE

A New and Efficient Substitute for "Nutrose," by B. L. Mackenzie Wallis, Temporary Lieutenant, R. A. M. C. *The Indian Journal of Medical Research*, Vol. iv, No. 4, April, 1917, p. 786.

Wallis, in some investigations carried out with the object in view of preparing an efficient substitute for the patent German food-stuff known as "Nutrose," was able to report results appearing to be remarkably successful. The preparation made by Messrs. Meister, Lucius, Brunning & Co., in his hands yielded results contrary to those hitherto recorded as representing its composition, namely: Water, 6.8 per cent; protein, 15.9 per cent; fat, 10.3 per cent; carbohydrate, 66.0 per cent; acid, 1.0 per cent.

"Nutrose" has always been classed amongst the dry milk products. The ordinary dried milk or casein, prepared by the Protene Company, is placed on the market as "Protene Flour"; casein combined with ammonia is sold as "Eucascin"; casein with soda, as "Nutrose"; casein with potassium, as "Plasmon." "Sanose" is said to contain 80 per cent of casein and 20 per cent of egg albumen, and "Sanatogen" to consist of casein and 5 per cent of sodium glycero-phosphate.

From his chemical analyses, Wallis concluded that nutrose contained peanut flour in quantity and that this constituent was the most important factor in determining the properties of nutrose. But both casein and peanut flour are insoluable in water and this fact staggered the investigator until he discovered that the addition of but one per cent of sodium carbonate rendered both these substances soluble.

After expressing the arachis oil, and exposing the resulting cake to the air and sun for some time, the peanut meal has the following composition: Water, 9.8 per cent; protein, 44.5 per cent; fat, 9.2 per cent; carbohydrates, 23.8 per cent; fiber, 5.2 per cent; ash, 7.5 per cent.

Not only, then, was it found that this flour had a high nitrogen content but there was evidence to show that it contained an active chemical principle of the nature of a "vitamine," although the latter "defied all attempts at isolation." Wallis finally succeeded in isolating a globulin from the peanut flour which, when mixed with casein and sodium carbonate, formed a mixture which was completely soluble in water and eminently suitable for mixture with agar to make up the well-known Nasgar medium. The final compound was made up as follows: Peanut flour, 94 parts; casein, 5 parts; sodium carbonate, 1 part.

With regard to the results obtained with the media for bacteriological purposes and the isolation of the colon-typhoid group of organisms, Wallis states: "The results so obtained were compared with those with the new nutrose media. In every case the differences were most striking. Not only did the typhoid and paratyphoid colonies appear more luxuriant, but they were individually much larger, etc." Not a little of this luxuriant growth is attributed to the vitamine content of the media.

We are, however, still more interested in what Wallis says with regard to

"The Use of the New Nutrose as a Food Stuff," on page 793: "From the analysis recorded above it seemed probable that such a highly nutritive mixture would be a valuable adjunct to various cereals in the preparation of a flour for bread making. It has long been recognized that peanut cake is a most useful food for cattle, combining, as it does, a high degree of nutriment, together with easy digestibility. It has further the advantage of cheapness, in that it is a waste product at the present time, the much more valuable arachis oil being sought for as a substitute for olive oil and for soap making."

The ingredients for the bread are: Nutrose, 10 ounces; salt, a trace; white of egg, from eight eggs.

"The whites of eggs are first beaten into a fine froth with an ordinary whisk, and the other ingredients slowly added with constant stirring. The mixture is placed in a baking tin and baked in an oven in the usual manner."

H. G. Beyer.

The Use of Aromatic Chloramine Compounds for the Sterilization of Water for Drinking Purposes, by R. L. Mackenzie Wallis, Temporary Lieutenant, R. A. M. C. *The Indian Journal of Medical Research,* Vol. iv, No. 4, April, 1917, p. 800.

It was Dakin who discovered the remarkable disinfecting powers of the chloramines and who first prepared a chloramine from the aromatic toluene, which he named "Chloramine T." It was later ascertained that the germicidal power of the chloramines was, molecule for molecule, greater than that of sodium hypochloride, and Cohen, Dakin, Daufresne and Kenyon came to the conclusion that chloramine T was the best reagent so far examined on account of its being easily made, relatively non-toxic, soluble in water and may be kept unchanged in the solid or the liquid state for a long period. These properties make chloramine T very valuable as a chemical reagent for sterilizing drinking water. Wallis found, when distilled or sterilized water was used in the experimental observations, that it was always necessary to add carbon dioxide to obtain the maximum effect of the added chloramine.

Wallis sums up the results of his observations in the following conclusions: (1) The aromatic compounds of chlorine are powerful germicidal agents when added to drinking water in small quantities. (2) Experiments with chloramine-T indicate that 0.04 gram will completely sterilize one liter of any water in ten hours, even when 10,000 organisms per cubic centimeter are present. (3) The water so treated is entirely devoid of any unpleasant taste and will remain sterile for at least four days. (4) There is evidence to show that its activity is markedly increased by the presence of organic matter in solution in the water, in fact organic matter is essential for the compound to exert its action as a disinfectant. (5) Chloramine-T possesses many advantages over bleaching powder as a chemical reagent for sterilizing water, more particularly its definite and unalterable composition, its stability in solution, non-toxicity, absence of corrosive action, and non-production of an unpleasant taste in the treated water. (6) All the results tend to demonstrate that we have in certain of the chloramines the ideal reagent for sterilizing water on a large scale.

H. G. Beyer.

The Carrel-Dakin Method of Treating Infected Wounds, by E. G. Schlesinger, M.B., B.Sc., F.R.C.S., Eng., Temporary Surgeon, R. N. *The Journal of the Royal Naval Medical Service*. Vol. iii, No. 3, July, 1917, p. 275.

The special merit, distinguishing this paper from some others on the same subject, is to be found in the very apparent fact that the method was tried out by skilful observers and thoroughly trained hands in laboratory, operating room, and bedside work.

As is well known, the object of the method is that of obtaining a rapid sterilization of infected wounds, so that they may be closed, either completely or partially, and the patient be spared the dangers and discomforts of a prolonged suppuration. The process is supposed to be accomplished by the introduction *into all parts* of the wound, at frequent intervals, of a suitable fluid antiseptic.

The author's choice, ultimately, fell on a solution of sodium hypochlorite, of standard strength, prepared by a method devised by Dakin and Dufresne. This method aims at securing a solution containing between 0.45 and 0.5 per cent of hypochlorite and the absence of any free caustic soda. The free chlorine of every sample of chlorinated lime must, first, be standardized by titration against decinormal sodium hyposulphite, using iodine as an indicator. The necessary quantities of anhydrous sodium carbonate and sodium bicarbonate, to be added to the solution, are then accurately determined. (For the details see original.)

The solution must be brought into intimate contact *with all and every* part of the wound and *without any diminution of strength*. This is supposed to be effected by Carrel's method of introducing the fluid by a system of rubber distributing tubes, leading to *all parts* of the wound. Immobilization of the parts is considered "in no way second to the actual local treatment."

The author makes a distinction between "sterilization in a surgical and a bacteriological sense." A wound may be surgically sterile, when it can be sewn up completely without subsequent breaking down or pus formation, "although cultures are still obtained from it! The progress of treatment must be bacteriologically controlled and it is by this means that one is to judge whether sterilization is sufficiently advanced to permit of wounds being closed with safety. "The average time taken to sterilize wounds at Carrel's hospital, in a large series of cases, was from six to twelve days for wounds of the soft parts, and from twelve to thirty days for compound fractures, in cases where the treatment was begun early, and our experience confirms this." This seems to be a very fair statement of the result obtained by the method.

While the chemical sterilizing power of the hypochlorites in infected wounds must be considered as beyond any reasonable doubt and as a fact, it would still be of considerable scientific interest if a parallel series of observations could have been made with normal saline, Ringer's or Locke's fluid, so as to produce comparative results. Such a series of contrasts might, perhaps, also contribute toward confirming the author's opinion with regard to the special attributes and actions of Dakin's solution on proteins: "Dakin's solution has the valuable property of rapidly splitting protein into soluble substances, which by their

reactions would appear to be amino-acids, and this property, which has been very little insisted on, appears to us to be perhaps the main factor in its success, and incidentally to open up the whole question of the treatment of septic wounds from a new viewpoint." Whether the result was brought about by a process of oxidation or one of hydrolysis would be immaterial, the different metabolites produced are not without some influence on either living tissues or microörganisms. This remains to be demonstrated!

H. G. Beyer.

A Simple Method for Maintaining Apposition of Divided Nerves and Tendons During Suture, by G. Letshal Cheatle, C.V.O., C.B., F.R.C.S., Temporary Surgeon General, R. N. *The Journal of the Royal Naval Medical Service,* Vol. iii, No. 3, July, 1917, p. 302.

The method is shown in the adjoining figure (Fig. 1). The first armed needle *A* is passed a diameter's length from the edge of the cut surface of one end to the corresponding point in the other; instead of completing the passage

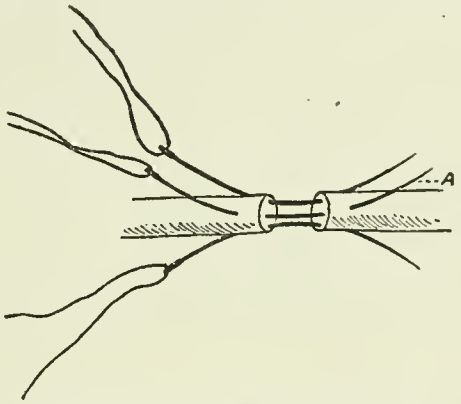


Fig. 1.—Showing the divided nerve-ends held in position by the transfixing and catgut-bearing needles.

of the needle it is left transfixing the ends and acts as a support and link by fixing the nerve-ends opposite each other. Then, at regular intervals, are passed into the nerve-ends four threaded needles, which are also left transfixing as in the case of the first needle *A*. Thus, the nerve-end being immobilized, the passage of the first needle is completed and tied in apposition; the other needles are tied in turn in the same way. When the time for the last needle has arrived, the completed sutures hold the nerve ends in sufficient apposition to allow the successful completion of the operation.

H. G. Beyer.

The Immediate Effect of Cigarette Smoking on Healthy Men and on Cases of "Soldiers' Heart," by John Tarkinson, M.D., Lond., M.R.C.P., Lond., and Hilmar Koefod, M.D., Harvard. *The Lancet,* August 18, 1917, p. 232.

In view of the well-known fact that many of our soldiers become unduly breathless on the exertion which military services entail and of the further

equally well-recognized fact of the universality of the practice among military men of the habit of cigarette smoking, the results obtained by experiments and accurate observations are always noteworthy, especially so when they bear the stamp of a fairly scientific interpretation which is certainly the case with the work under present discussion.

The attention of the author was chiefly directed to the effect of smoking (1) on pulse, respiration and blood pressure, and (2) on reaction to exertion. This effect has been ascertained in healthy men and in soldiers unduly breathless on exertion, by instrumental methods wherever possible, and their conclusions are therefore regarded as of permanent value:

1. The immediate effect of cigarette smoking upon the circulatory system and upon the breathlessness of exertion was observed in 30 smokers, of whom 20 were cases of "soldier's heart" and 10 were healthy soldiers. Each subject smoked either four or five cigarettes during a period of 40 minutes.

2. A demonstrable effect was recorded in 17 of the 20 patients; the 3 unaffected were non-inhalers. Nine of the ten controls, all inhalers, were influenced in the same fashion, though not to the same degree.

3. The average pulse-rate among the patients during smoking was nine beats higher than before smoking; in the healthy controls it was six higher. Initial slowing of the heart was never observed, nor any irregularity referable to smoking.

4. The rate of respiration in the patients was unaffected; in the controls it was slightly reduced.

5. The average systolic blood pressure was raised by 5–10 mm. Hg. and the diastolic by 5 mm., both in patients and controls.

6. These effects appeared within five minutes; with the first cigarette they almost reached the maximum, and this was maintained throughout the smoking period.

7. A simple exertion test was performed before smoking and repeated on its cessation. In the patients the pulse-rate maintained a higher level throughout the test *after* smoking, and half of them were more breathless both subjectively and objectively. In two patients precordial pain was induced by smoking, apart from exertion. But in the controls the pulse-rate curve during exertion was much the same after smoking as before, and breathlessness was induced in two only.

8. These observations show that, in health, the smoking of a single cigarette by an habitual smoker usually raises the pulse-rate and blood pressure perceptibly; and these effects are a little more pronounced in cases of "soldier's heart." Moreover, the smoking of a few cigarettes can render healthy men more breathless on exertion, and manifestly does so in a large proportion of these patients.

9. Excessive cigarette smoking is not the essential cause in most cases of "soldier's heart"; but, in our opinion, it is an important contributory factor in the breathlessness and precordial pain of many of them.

H. G. Beyer.

Physiological and Antiseptic Action of Flavine, by Alexander Fleming, F.R.C.S., Temporary Lieutenant, R.A.M.C. *The Lancet*, September 1, 1917, p. 341.

To the discriminating student of present-day medical literature it cannot have escaped that the problems of preventing the occurrence of the specific infectious diseases and the more general infections, following war-wounds, are occupying today as, perhaps, never before in the whole history of medicine, the serious attention of the best medical talents of the civilized world. The modern projectile, the bomb and the shrapnel seem but clumsy imitations of the bacillus, the bacterium and the coccus, as factors in the battle for the destruction of human lives with which the whole world is at present engaged. It is always the subtle, the unseen, the secret factors in all human affairs, in peace or in war, that have proved themselves to be the toughest, most unyielding and the most implacable enemies of peaceful human existence. What wonder, then, that the most honest, the bravest, the brighest, the most truly patriotic and the most scientific among us are devoting their untiring attention to the study of the prevention or cure of the ills of which these are the direct causes.

The work of Fleming is suggestive in many directions. Aside from the scientific physiological methods employed and the definiteness of the findings, the frankness and irresistible logic with which the results are rendered are, indeed, confidence-inspiring and well worthy of emulation in these days of greed and "camouflage:" "I propose to set forth in this article the results of some experiments I have made with flavine, which show that the claims which have been made that this substance approaches the ideal antiseptic are based on fallacious experiments and that by altering the experimental conditions slightly the therapeutic coefficient can be altered to an enormous extent. I will also show that the action of flavine on living tissues (as exemplified by leucocytes) is far in excess of its lethal action on bacteria." As shown in the following summary of results, which may be accepted without hesitation, Fleming has made good:

1. Flavine strongly agglutinates human red corpuscles up to a dilution of 1 in 3,200.

2. Flavine has a strong anticoagulant effect on human blood.

3. Flavine in a concentration of 1 in 2,000 completely inhibits leucocytic emigration.

4. Flavine has a very destructive action on leucocytes, and if the action on leucocytes and bacteria be each tested for 24 hours its leucocidal action is far in excess of its bactericidal action.

5. The number of microbes on which an antiseptic has to act has a very marked effect on the "lethal concentration" of the antiseptic.

6. This alteration of the "lethal concentration" with the number of microbes varies in degree with different antiseptics, and appears to be especially marked in the case of certain aniline dyes. This factor must in all cases be taken into account in any comparison of antiseptic values.

7. When many microbes are used it requires a much greater concentration of flavine to effect sterilization than that given as the "lethal concentration" by Browning and his co-workers.

8. In serum under certain conditions staphylococci will grow in 1 in 32,000 flavine, *B. coli* in 1 in 1,000, and *B. proteus* in 1 in 2,000.

9. Flavine 1 in 8,000 appears to aid the growth of *B. proteus.*

10. Flavine 1 in 500 is usually unable to sterilize in 24 hours an equal volume of pus from a wound.

11. Flavine injected intravenously in large doses immediately disappears from the blood, which acquires no bactericidal power, and is taken up by the tissues, which became yellow but acquire no inhibitory power on the growth of bacteria.

12. Flavine 1 in 100 injected into the pleural or peritoneal cavities loses its antiseptic power within two hours.

13. Flavine is rapidly absorbed by pus or muscle tissue.

14. The so-called "therapeutic coefficient" of flavine can be changed with slight variations of the experimental method by at least 300,000 times.

15. If the antiseptic is allowed to act on staphylococci and leucocytes alike for 24 hours and the ratio is taken of its toxicity to both of these, carbolic acid has a coefficient 10 times better than flavine when the antiseptic acts on the microbes in serum and 250 times better when the bactericidal action is estimated in pus.

Exit Flavine as the ideal antiseptic!

Wherever and whenever, during the last few decades, the medical profession has been able to report real and enduring progress in the treatment of any of the known infectious diseases, it was almost invariably due to the fact that a specific antibody against the etiological factor of that disease had somehow been produced by somebody. Up to that point and before that had been accomplished, the treatment of that disease was merely symptomatic, haphazard and empiric. Prevention of such a disease was altogether out of the question and absolutely impossible, even admitting the fact that we had, in the meantime, learned to limit its *spread* through the application of general sanitary measures, thus preventing it from assuming the epidemic form.

The physician, with his vaccines and antitoxines, was now very nearly in the fortunate position of the surgeon about to perform an operation in his perfectly equipped aseptic operating room—he could fortell the result of his treatment with scientific accuracy. It may even be said that the physician, with his specific remedies, went much further than the surgeon with this asepsis. What the surgeon accomplished by merely external cleanliness, the ultimate result of applied, preventive hygiene, the physician, with his specific antibodies, accomplished in the remotest recesses of the human organism, accessible to the circulation. *Chirurgus sanat; medicus curat.*

War-diseases and War-wounds.—The problems before the general physician and the general surgeon under war conditions are naturally much more difficult of solution than are those presented under the peaceful conditions of civil life. But, here also, we find that the parallel drawn between the physician's and the surgeon's work shows up the former in a more favorable position than that of the latter, notwithstanding the great advances in surgical technique induced directly by the astounding variety of war-wounds. This must be attributed

to the fact that the physician, provided with specific means, was also much better prepared to meet the dangers of war-diseases than the surgeon was, with his aseptic technique, to meet the emergencies of infected war-wounds. Wherever the physician was able to proceed with specific remedies, he was successful to the point of practically eliminating the commonly known infectious diseases from the war zones; wherever these failed him, his efforts came to a sudden standstill, being thrown back on the more general methods of treatment in practice during prebacteriological days. The surgeon, on the other hand, had never been provided with nor was he prepared to treat a war wound, dirty and infected, by specific means, such a specific has, up to date, not yet been discovered, and the only resource left to the surgeon, therefore, was an attempt to extend his aseptic surface technique to the interior of the wound surfaces, throughout the entire wound cavity. In this attempt, mechanical means had to give way to solutions of chemical substances. The purely chemical method of Carrel-Dakin and the more physiological method of Sir Almroth Wright are the two best known methods that have so far been employed with the aim of rendering an infected wound, at least, surgically sterile; these have been but partially successful, stopping short of the desired aim, neither the hypochlorites nor the hypertonic salt solution possessing the biological characteristics of specific antagonists against the invading microorganisms of war wounds.

Even if we do not, without further proof, accept the statement of Sir A. Wright that the body fluids acquire, in cases of war wounds, an increased power to antagonize any and all sorts of microbes by which a wound may have become infected, his method seems to us to approach nearer to perfection than that of Carrel-Dakin in that it not only removes infectious material from the wound cavity but antagonizes pullulation of microbes, calls into activity the phagocytic action of the leucocytes and the antitryptic power of the body fluids, prevents the absorption of microbes and their toxines, thus securing possible safety from infection during a prolonged transport which most of the transportable and severely wounded have to undergo before arriving at a hospital for further treatment.

All this might, however, also, easily be accomplished by a prompt and thorough exposure of the infectious agents to the action of the hypochlorites.

In the meantime, both physicians and surgeons are condemned to a state of "watchful waiting" for more light from the much needed work of chemical and biological research.

H. G. Beyer.

Investigation into the Effects of Cold upon the Body, by Norman C. Lake, M.D., M.S., D.Sc., Lond., F.R.C.S., Eng., Temporary Captain R.A.M.C. Thesis for the degree of D.Sc., Lond. *Lancet*, October 13, 1917, p. 557.

From a series of interesting experiments with cold upon living tissues, carried out with purely physiological methods, Lake was led to the conclusions that cold, down to —6° C. brought about a state of suspended animation, in which, for considerable periods, the tissue could be preserved intact and its potential vitality maintained at the normal standard, while an exposure below —6° C., would, invariably, result in its destruction: "We again state that the effects of

cold below and above —6° C. respectively can in no way be compared—the one is chemical, the other physical, and the difference between them is as great as that between a mixture of hydrogen and oxygen gases in a tube and the water which results from their chemical combination." For Lake, —6° C. is the critical temperature in the life of the tissues, whether these be in the isolated condition or in their normal relationship to the body; he, accordingly, would have us distinguish between *true frostbite*, occurring at temperatures below —6° C. and mere *chilling of tissues*, taking place at temperatures above —6° C.

In *true frostbite* in which, according to Lake's researches, an actual destruction of the tissues concerned must be assumed as having taken place, a rapid and abundant exudation of fluids and cells from the destroyed vessels into the surrounding tissues must follow. This exudation may be so extensive as to lead, through local pressure, to the complete cutting off of all blood supply and, consequently, to gangrene.

In the mere *chilling of the tissues*, in which these must be supposed to have retained their potential vitality and in which, therefore, the damage done is not beyond the possibility of restitution to a normal condition, the danger is to be sought in the excessive exudation which we must expect to occur as a consequence of the great rise in capillary pressure, brought about by the gradual relaxation of the arterioles, previously in a condition of extreme contraction through the cold to which the parts had been exposed: "At the start the arterioles are contracted practically to obliteration and pressure in the capillaries and veins is at a minimum. As the temperature rises the involuntary muscle fibers (in the arterioles—Rev.) become relaxed and for the time paralyzed. An enormous dilatation of the arterioles, therefore, ensues and the full arterial pressure is transmitted to the capillaries. Whether the endothelial walls of these be damaged or no, the rise of pressure is so great as to cause the fluid contents of blood to filter through the walls in exactly the same manner as serum passes through a porcelain filter, when the pressure is sufficiently raised."

This pressure is still further increased by that exerted by the exudation on the veins immediately adjoining the capillaries and this, again, would explain the danger to be feared from constricting bands in this condition.

If, therefore, and, in view of these fundamental conditions, in cases of trench-foot, for instance, this capillary pressure can be kept low, while the arterioles recover their normal tonus, either naturally or through the administration of vaso-constricting chemical substances, as adrenaline, strychnine, etc., on the one hand, and the venous obstruction is removed through gentle massage, on the other, then the condition may become amenable to successful manipulation.

The chief danger in both conditions, in true frost-bite as well as in the chilling of tissues, lies in the ensuing capillary over-pressure, followed by excessive exudation, both of which must, at all events, be kept down by a timely and proper treatment of the parts.

Quite recently, some of our Italian colleagues, examining frozen parts histologically, have pointed out rather significant changes as occurring in the elastic fibers of certain blood vessels; whether these are subject to the same —6° C. temperature law established by Lake, or not, does not appear from his report.

H. G. Beyer.

BOOK REVIEWS

Blood Pressure—Its Clinical Applications, by George William Norris, A.B., M.D. Philadelphia: Lea and Febiger, 1917.

This work is a very timely, intelligent and complete treatise of a subject of great interest to every practicing physician and surgeon, as well as to life-insurance examiners and men engaged in making physical examinations for the Army and Navy.

It is an excellent guide on a subject about which there has been much discussion and not a little misconception, misunderstanding and misinformation in current medical literature. The work is written in a clear style, the illustrations are adequate, and the treatment of the subject well arranged.

There are excellent chapters on the physiology of blood pressure and good descriptions of the different types of apparatus for registering it, with diagrams. Then follow chapters on venous blood pressure, arterial hypertension, blood pressure in various acute and chronic diseases, and exogenous intoxications. The chapters on blood pressure changes from normal in cardiac diseases, arteriosclerosis and nephritis and the effect of drugs and granular extracts are particularly interesting. Chapter XI, beginning page 274, gives an excellent summing up of the significance of increased blood pressure and clears up a good many misconceptions on this subject.

Altogether this work is admirably arranged and clearly written, and the whole subject is well considered. It contains practically everything of value that has been learned by laboratory experiment and clinical experience on the subject, and wastes neither the writer's space nor the reader's time in the discussion of abandoned theories.

It may be safely said to contain everything of any value on the subject that has been developed up to the present time. Wm. H. Arthur.

The Treatment of Infected Wounds, by A. Carrel and G. Debelly; translation by Herbert Child, Captain, R.A.M.C. (ty.), formerly Surgeon French Red Cross. Introduction by Sir Anthony A. Bowlby, R.C., M.G., K.C.V.O., F.R.C.S., Surgeon General Army Medical Service, Advising-Consulting Surgeon to the British Armies in France. New York: Paul B. Holber, 1917. Price, $2.00.

This most timely and useful translation is an exposition in detail of Carrel's method of treating infected wounds. The book conveys in the clearest manner the knowledge of those details which have been so carefully elaborated by the patient work of two years. It repeatedly emphasizes the fact that it is only by scrupulous attention to every detail that the best results will be obtained. In the preface Sir Anthony Bowlby urges that, if the method is to be fairly judged, no change whatever should be made either in the Dakin's solution itself or in the use of the tubes for instilling it. He deplores the tendency to "improve" the method and states that the only modification that seems justifiable is the use of the syringe when instillation by gravitation can-

not be carried out, as in trains, ships and many units at the front. The original method should be given a prolonged trial before modifications are introduced.

Interesting observations, facts and figures are presented in the authors' introduction. Sir Almoth Wright's teaching that "the treatment of suppurating wounds by means of antiseptics is illusory, and that belief in its efficiency is founded upon false reasoning" is attacked and, the reviewer believes, successfully. It is shown that it was a mistake to completely forget the fundamental observations of Lister and treat wounds with saline solutions or the hypertonic solutions of Wright. It being apparent that surgical infection, at the outset, is always local and in war wounds is carried by projectiles, and especially by fragments of clothing impregnated with microörganisms, the question then is simply how to destroy them without harming the tissues. As a difference of resistance exists between, on the one hand, the tissues provided with a circulation, and, on the other hand, microbes, isolated anatomical elements and necrosed tissues, it was useless to seek a substance which would exercise an elective action on microörganisms. Better seek to discover, for a given antiseptic, that degree of concentration of the solution and length of time during which it must be applied, which, though fatal to microbes, will not produce obvious damage to the tissues. The method is one of chemio-therapy and is the result of Dakin's studies of the action of many different antiseptics on tissues and microörganisms. Chloramines and hypochlorite of soda are the chemicals finally selected as they are endowed with feeble irritating qualities, with a toxicity almost nil, but of considerable bactericidal power. Research demonstrated that the microbes disappeared if the antiseptic remained in contact with the surface of the wound at a certain degree of concentration during a prolonged period. This demonstrated the falsity of Wright's contention.

It is maintained that the infection of war wounds would be unsuitable for treatment by vaccines and serums, as the inoculation of the tissues by projectiles or fragments of clothing is massive and the germs protected by necrosed tissues or blood-clots multiply beyond the reach of the lymph flow. The bacterial flora of war wounds is extremely varied and, as the large numbers of wounded and the conditions of the dressing stations render impossible identification of the microbes which infect the wounds, it would be necessary to use vaccines or serums against dozens of types of germs, aerobic and anaerobic, an obviously impracticable procedure.

The method was applied first to old wounds, and later to recent ones as a preventive measure. Infection can be checked even after suppuration has become established. All infected wounds are now brought more or less under control by chemio-therapy.

It is a matter of deep regret to the authors that the method has met with so much opposition from men at the head of the medical profession in France that it has been employed, in its integrity, in only a limited number of hospitals. They state that the best way to learn the method is to see it applied, and the book is intended to recall essential details of the technique to those who already know something of its application.

FRANCIS M. MUNSON.

Elements of Field Hygiene and Sanitation, by Joseph H. Ford, Colonel, Medical Corps, U. S. Army. Philadelphia: P. Blakiston's Son & Company, 1917. Price, $1.25 net.

Colonel Ford's manual of 240 pages discusses personal hygiene, the march, camps, water, the messing of troops, camp diseases, and gives illustrative regulations concerning camp hygiene and sanitation. It contains an excellent index. While the book is a little too large to carry in the pocket, it is small enough to be included with ease in the field equipment of a medical officer, and the writer would recommend that it be so carried for the following reasons:

1. It is a skillful condensation of the principles of field hygiene and sanitation.

2. It contains the experience with various sanitary devices gathered by our troops and medical officers in the expedition into Mexico, and the author has also had first hand experience as an observer in the present war.

3. The book contains 152 illustrations, mostly of sanitary devices, usually with detail drawings and other information which will enable the sanitary officer to construct them.

This third feature is especially valuable. However well the medical officer may know the principles of sanitation, these principles are of little value until they are applied. Unless the sanitarian is a practical inventor, he will find much difficulty in making an efficient device to meet the immediate necessity. Even if he is an inventor, it will do him no harm to first ascertain the merits and defects of the devices that have been tried already.

For this purpose the book will be a very useful addition to the working library of sanitary officers, and it is to be recommended to medical officers recently called into the service as a concise exposition of the principles of field hygiene and sanitation.

E. B. Vedder.

Surgical Nursing in War, by Bundy. Philadelphia: P. Blakiston's Son & Company, 1917.

A timely booklet with valuable suggestions for all nurses but especially for those who contemplate service in military hospitals. Information has been collected from many sources concerning new methods of treatment based on well-established principles, and the result is not only interesting reading, but there are numerous practical and important points peculiar to war conditions clearly set forth.

G. M. Nevins.

Ambulance de "L'Ocean" La Panne (Belgium). Travaux publics sous la Direction du Dr. A. DePage. Secretaires de la redaction, Dr. A. P. Dustin, Dr. G. Debaisieux. Fascicule 1, Juillet, 1917. Masson et Cie, Editeurs, Libraires de L' Academie de Médicine, 120, Boulevard Saint Germain, Paris.

This is the first number of a semi-annual periodical published to show the activity and results attained at the great Belgian Red Cross Hospital established at La Panne at the suggestion of Elizabeth, Queen of the Belgians. La Panne is on the North Sea, just inside the French frontier and about 12 kilometers

behind the trenches. The hospital owes its name, "Ambulance de L'Ocean" to the fact that the first building occupied was l'hôtel de l'Ocean.

The introduction is a full and interesting description by Dr. A. DePage, the director, of its foundation, evolution and organization. This last is now thorough and complete. Its capacity is 1,000 beds, but in case of necessity this can be raised to 1,200 or 1,500. The average number of patients is from 500 to 600. It was established at La Panne in order to have a hospital complete in itself on Belgian soil, as near as possible to the trenches where the seriously wounded could receive early and competent treatment and the cases retained until complete convalescence, thereby enabling the medical service to make intensive studies and compile reliable statistics.

An annex to the hospital, an advanced post, so to speak, has been established near Dixmude, 3 kilometers from the front, for urgent operations on wounds of the abdomen. This is composed essentially of four automobiles arranged in a rectangle and supporting a double walled tent, heated by electric radiators and containing 14 beds. The automobiles contain the pharmacy, linen-room, dark room, sleeping quarters for the medical personnel, etc. In addition to laparotomy cases, severe external hemorrhage and shock are treated.

An important adjunct to L'Ambulance de L'Ocean is L'Institut "Marie DePage" for the study and perfection of the treatment of wounds of war and the conservation and utilization of the innumerable scientific records furnished by the study of the patients treated at the hospital since its foundation. Funds from America paid for the construction of the pavilions, the Rockefeller Foundation paying for the installation of the different laboratories.

The first monograph, "General Considerations on the Treatment of Wounds of War," is a brief but clear résumé of the subject. The Carrel-Dakin treatment is unqualifiedly approved and described in detail. The secondary suture of war wounds is well described and illustrated in the second article.

An excellent and most enlightening study is presented of cranio-encephalic wounds. Among the conclusions reached are the following:

1. Every wound of the scalp should be well cleared of débris.

2. All bony lesions of the skull require trephinning.

3. The gravity of cranio-encephalic wounds results from the existence of meningeal lesions.

4. The early removal of all foreign bodies, including the projectile, should be practiced.

5. Simple wounds of the head should be sutured at once; those slightly infected, after 48 hours. Others should receive the Carrel treatment with secondary suture.

6. The results, excellent in simple head wounds, become much less so in the case of complicated lesions. Immediate intervention constitutes the treatment which prevents the most complications, immediate and late.

7. Cranioplasty (cartilagenous and osseus) is indicated for protection and for esthetic reasons.

8. The prognosis of cases trephined early is less dark than is generally admitted.

A chapter on the reduction and mechanical retention of fractures of the jaws is well illustrated.

Favorable results are reported from the intravenous injection of peptone in the treatment of grave pyogenic infections.

The chief of the neurological service urges that all wounded patients be given a neurological examination soon after entering the hospital, and provision made for their early treatment by specialists.

The technique of surgical intervention in wounds of the peripheral nerves, as practiced at "L'Ambulance de L'Ocean," is described and illustrated.

Several instructive and timely monographs are presented giving the results of research work in "L'Institut Marie DePage." These are "Prophylaxis" and "Treatment of Tetanus," "Researches on the Blood Pressure in the Course of Intoxications by Gas," "Apropos of the Employment of Sugar in the Treatment of Wounds Infected by the Bacillus Perfringens," "Apropos of the Presence of Bacillus Perfringens in Recent Wounds," and "Examination of the Uniforms of the Belgian Soldiers from the Point of View of the Presence of the Spores of anaerobic Bacteria and more particularly of the Spores of Bacillus Perfringens."

FRANCIS M. MUNSON.

THE TREATMENT OF WAR WOUNDS. Compiled at the request of the National Research Council by W. W. Keen, M.D., LL.D., Emeritus Professor of Surgery, Jefferson Medical College. Philadelphia and London: W. B. Saunders Company.

This timely report does not pretend to be complete, but is only a memorandum on some of the more important and most recent improvements in the treatment of war wounds and, coming from the authoritative pen of Professor Keen, himself a Civil War veteran, will be most useful to medical officers about to take part in the great conflict.

The author brings out the following points wherein, from a surgical point of view, the present war differs from any preceding wars: (1) The huge numbers in the armies and, therefore, of the wounded; (2) the new means of transportation; (3) the new weapons, especially in the artillery; (4) rampant infection of wounds; (5) the conquest of infection by more efficient anti-septics and by new methods.

He also mentions, but does not discuss, the advance in reconstructive surgery of the face and jaws by the coöperation of the dentist and the surgeon, the great development of war orthopedics and the training of disabled soldiers. He also calls attention to our reversion to medieval steel helmets and corselets as a means of preventing wounds.

Under the first heading he states that in the care of the thousands of urgent cases requiring treatment after each "drive," the greatest good of the greatest number must be the rule, but, on the other hand, an abdominal case or a case of internal hemorrhage, even if it does involve time, must have precedence of a dozen who can wait. For the same reason and for want of the needed aseptic conditions, few abdominal cases, and few if any injuries involving the brain, should be operated on near the front. Shock from severe wounds and hemorrhage must take precedence of everything else.

The importance and advantage of the new means of transportation by automobile, whereby the wounded may be brought to the hospitals within a few hours, is commented upon. Diagrams are given, showing the zones of collection, evacuation and distribution in the United States Army and in the British Army. New methods of treatment during transportation, especially of fractures, are mentioned.

The changing character of the wounds received in this war is referred to. At first bullet wounds predominated, then shrapnel, and now the high explosive shell is the chief weapon. Emphasis is laid upon the certainty of infection in neglected wounds and the widespread devitalizing of the tissues caused by the shell fragments. The common-sense practice of excision of the tissues surrounding the wound itself, after primary disinfection, is endorsed.

The failure of both antisepsis and asepsis, as at first practiced in this war, is explained as being due to the lack of sufficiently effective antiseptics and to defective technique. Prevention and cure of sepsis are now both possible by the Dakin-Carrel method which is described in minute detail.

The apparent merits of "acriflavine," "proflavine," "mercurophen," "eusol," "cupad" and "brilliant green" are spoken of and their further test by a more extensive use is urged.

The author embodies in the report a brief statement of the general principles underlying the removal of foreign bodies by the aid of fluoroscopy, by Dr. E. W. Caldwell of New York City. This writer gives, in some detail, the method used to obtain the stereo-fluoroscopic image which shows the relation of the exploring needle to the foreign body as accurately as it could be seen if exposed in the open air.

The prophylaxis and treatment of tetanus is dwelt upon and the Memorandum on Tetanus, issued by the British War Office Committee on the Study of Tetanus, in which the necessity of several successive protective doses of serum is properly emphasized, is appended.

Gas infection and gas gangrene are described, and the paramount importance of the earliest possible treatment during the first stage of rapidly spreading infection, before the production of gas in any serious quantity has occurred, is emphasized. The recent announcement, by the Rockefeller Institute, of an antitoxin to prevent gas gangrene is mentioned and the experiments and reasoning leading to its production are approved.

Under the caption, "Wounds of the Head," Professor Keen quotes and endorses the conclusions of Dr. Harvey Cushing in his articles in THE MILITARY SURGEON, June-July, 1915, as follows:

"There is a fairly universal agreement that almost all cranial wounds produced by projectiles, even though they appear trivial, require surgical investigation, with the possible exception: (1) of certain of the tangential longitudinal sinus injuries, which, according to Sargent and Holmes, have a high degree of spontaneous recoverability, and which, when investigated, present unusual surgical risks; and (2) of certain of the fractures of the base due to perforating wounds, owing to their inaccessibility."

Early surgical interference in cranial injuries, except for the control of ex-

tensive hemorrhage, is not approved. The author insists that the only proper hospital in which to operate on such cases is one in which facilities in skilled men, both neurologic and surgical, and the best X-ray apparatus, are to be had. Exeision of wounds of the knee joint, with primary closure of the joint, is approved.

The report states that in wounds of the abdomen, section is now the rule, unless there is good reason to believe that the viseera have *not* been wounded. This is due to the great increase in wounds inflicted by bombs, grenades and high explosive shells. The importance of the earliest possible operation is emphasized.

The technique of the treatment of burns by improved paraffin dressings is deseribed and two formulae are given.

FRANCIS M. MUNSON.

LES PLAIES DE GUERRE DU POUMON (The War Wounds of the Lungs). Notes on their surgieal treatment in the war zone, by Pierre Duval, Medéein-Chef de l'Ambulanee chiurgicale automobile, No. 21. Paris: Masson et Cie, Editeurs. Libraires de l'academie de medécin, 120 Boulevard Saint-Germain, 1917.

This brief but coneise work is the result of the observations in eommon of the surgeons, physieians, bacteriologists and radiologists of the ambulance unit of whieh the author is chief. It is not a complete study of the war wounds of the lungs, but a short treatise on the particular points that have attracted their attention. Having in view the veritable revolution in the surgery of the lungs that has been presented during the war, they plead for the application to wounds of the lungs of the general rules of military surgery and maintain that this is superior to expectant treatment. Statistics are given showing the great mortality from wounds of the lungs and an appeal made for efforts toward improved treatment.

The ehapter on Pathologie Anatomy contains several fine plates in colors and several photo-engravings of radiographs. The conclusion reached from a study of hemorrhage and its treatment is that direct hemostasis of dangerous hemorrhages from wounds of the lungs would save two-thirds of those so wounded, and that thoracotomy is the procedure of choice. The various infections of wounds of the lung are deseribed, as well as that of the hemothorax which accompanies them. It states that a great number of reported cases of traumatic pulmonary gangrene are in reality cases of abscess of the lung and of septie pneumonia, and that gaseous gangrene of the lung had not been encountered.

Under the heading of Operative Treatment the following observations are made:

The great mortality calls for all efforts to find a better treatment.

It is due to infectious pleuro-pulmonary complications so frequent in wounds of the lung.

The examination of pulmonary fragments shows that wounds of the lung are entirely assimilable to every wound of warfare, in that the lesions are the same, the bacteriologic state is identical, the anatomieal lesions are charac-

terized by the same destruction, the same cellular mortification and the same hemorrhagic infiltration, wounded lung, as wounded muscle, is a medium well suited to the culture of the organisms of infection. Wounded lungs contain the same foreign septic bodies, projectiles, débris from the clothes and splinters. In view of the foregoing the author inquires why it is not logical to apply the general precepts of military surgery to wounds of the lungs, and states that the immediate treatment of the wounded organ is the only rational treatment. This alone avoids the most grave of the early or late complications, pleuropulmonary infection. The opportune time for surgical intervention is discussed and the conclusion reached that on this point, as on others, the general rules of military surgery should be followed.

The surgical treatment of the wounds of the lung known as "open thorax" in which the air penetrates directly into the pleural cavity at every respiratory movement, is described. Arguments are presented favoring a complete operation, *e. g.*, the removal of foreign bodies, etc., and not the simple closing of the wound. It should be considered a curative procedure and not a simple prophylactic measure.

Operative technique is described in detail. Operating rooms for hypopression and apparatus for respiratory hyperpression are stated to be physically rational, but their employment is limited by their inconvenience and their difficulty of transportation. It is maintained that thoracotomy with total pneumothorax does not impose any limitation on the manipulation of the lung and is the procedure of choice for intrathoracic interventions.

Local anesthesia by cocaine is given as the method of choice for early operations.

Thoracotomy according to the method of Willy-Meyer is described and illustrated. The examination of the lung, hemostasis, the extraction of foreign bodies, the treatment and suture of the wounded lung and pleura, the closure of the thorax, the treatment of the parietal lesion and the post-operative treatmen are dealt with in detail.

This book is the last word from those best able to speak on the subject.

F. M. Munson.

REPRINTS AND TRANSLATIONS

WAR DIARY OF A CONSULTING SURGEON WITH THE ADVANCE

By Professor C. GARRÉ, of Bonn, Germany

Generalarzt, VIII Army Corps[1]

THE mobilization of the army for war is completed. After spending days of nerve-wrecking suspense our brave troops, marching, enter the town of ——— with hurrahs. Shell shattered bridges, demolished depots and positions, uprooted trees obstructing the road, show us that we are now in the enemy's territory.

St. H———, the beautiful town with its old cathedral, becomes the gateway of our advance. The headquarters of our commanding general arrives the next morning and regiment after regiment passes in review before the commander; the light field artillery as well as the heavy howitzer batteries, in splendid equipment of horses and men, clatter by at an easy trot, followed by ammunition columns, hussars, cuirassiers, machine guns, wireless telegraph and telephone companies, field hospitals and ambulances, the transport corps in long columns, the aviators, the heavy pontoons of the pioneers and all the other formations of a modern army.

From 9 o'clock in the morning till 7 o'clock in the evening they march past, a tremendous reserve army and a striking picture of a nation's strength.

A captured spy, who was led blindfolded by some of our soldiers, and some wounded from the enemy's ranks completed the picture in all its seriousness. The first wounded who needed our medical assistance were French soldiers who were captured by our advance cavalry; they and our wounded men found shelter in the homes surrounding the battlefield. Many a brave fellow there received first aid for his injuries, who continued the fight in a most heroic manner after being wounded. I especially remember one of these cases, a cuirassier, who, after having been shot through his left arm and the abdomen, stayed in his saddle, escaped the enemy and came galloping into our quarters one hour after receiving his wounds. He and another enduring hero, Captain H., whose right lung was pierced by the enemy's lance, recovered completely, and I had the satisfaction to meet them four weeks later as convalescents at the field hospital in B———.

[1] Through kindness of Maj. John R. McDill, M. R. C., U. S. A., lately with the American Red Cross in Germany.

The following day (Aug. 22) found our corps as flanking guard to protect our action against the village G———.

Aug. 23. A frosty foggy morning. Advancing over narrow meandering roads, leading through field and woods, we pass our own-marching divisions. We hear the first shots fired by the enemy and after having passed the hillside which lay before us, we suddenly find ourselves on the battlefield, the scene of a night attack. The fighting is still on in the nearby village, whose inhabitants treacherously fire upon our soldiers from their hiding places. This attitude made it necessary for our men to storm every house separately before taking possession of the village.

Our surgical staff had already erected temporary quarters and was in full action. On a gentle slope of a nearby field the wounded were laid out and given first assistance. Those found to be severely wounded were carried on stretchers into two nearby primitive huts. The entrance into one of these was obstructed by the cadaver of a horse. In these low, dimly lighted rooms I found more than a dozen soldiers, suffering from shot wounds (mostly in the chest and abdomen), which had already been dressed by their respective regimental surgeons. I cannot pass without commenting on the most remarkable self-control and bravery of these poor boys; not a moan, no complaint escaped their lips, and only the twitching muscles and sorrowful eyes gave evidence of their untold sufferings.

In the meantime a field hospital had been erected in the neighboring village G——— (3 km.) and there these wounded were transported. As the fighting went on and more and more wounded were brought in from the battlefield, it became necessary to establish two new surgical staff quarters and also two additional field hospitals. Towards evening the roar of the cannons ceased and the reports of the rifles grew faint and fainter, giving evidence that the enemy was retreating. We at once proceeded to search the blood-drenched cornfield for the wounded, caring for friend and foe alike.

Upon entering the little village of P———, we found most of the buildings afire. Wounded, prisoners and franctireurs, who were caught redhanded, are led away. Along the roadside, in orchard and field, the dead lay as they fell, Frenchmen and Germans side by side, all strife ended. Lamenting women weeping aloud are searching the ruins for their dead and others make vain efforts to drive the cattle from the burning stables.

Our troops advance on the main street as the guns of the enemy proclaim the continuance of the fight. A few miles further we again come upon the enemy, who here holds a strong, well fortified position in the

village of B———. One of our divisions is ordered to charge immediately and at 6 o'clock the enemy retreats. Half an hour later the Surgeon General and I are busy looking for suitable quarters for the wounded in the captured village. Field ambulances are rushing to and fro, bringing in the maimed and suffering victims of the day. Sentinels on duty are guarding every roadway leading into the village, giving all necessary information; but in spite of their watchfulness our adjutant is shot and falls from his horse just as he leads the regiment through the village, a victim of a cowardly franctireur, who fired the fatal shot from the window of his barn.

Fortunately for our men the sentiment towards our troops is not as hostile and treacherous amongst all the villagers. As an example I found 8 severely wounded in one dwelling, where upon beds, tables and kitchen chairs resting places had been arranged by an old woman, who gave these men motherly care. In the trenches in the rear of this house the wounded were lying amongst the dead, and the former were trying to assist each other in cleaning and dressing their wounds in true comrade fashion, using the small well-known packages of first-aid supplies. I saw three different styles of the "pansement individuel," each being larger than the package customary to the German army.

Our services were then required in the neighboring village of H——— (5 km.) where the 2d Sanitary Company had its headquarters. Hospital tents were erected on the open field and about 80 to 100 wounded were cared for. Some amputations were necessary and were performed successfully.

We hear that Colonel P. and some officers are lying wounded in a small inn nearby. Arriving there we find that our friends are already in the care of an army surgeon.

Meanwhile darkness had set in; we try to find the staff of our commanding general, but are warned not to pass through the forest, as not an hour ago two of our cyclists had been shot therein by snipers. The problem now is to find shelter for the night. The little depot is overcrowded with French captives and interned Belgians—a forbidding looking crowd. The inn across the road is filled with our wounded and the bar is rushed with our men who try to get a glass of beer or wine. Finally we succeed in finding a few vacant beds in a neighboring hostelry but, being without any food since 4 o'clock in the morning, we are so hungry that we cannot sleep. All we could get was half a loaf of bread and a bottle of wine among three.

Aug. 24, 1914. We break camp at 4 a. m., visit two field hospitals and try to get in touch with our staff. The field hospital in St. D——— was not yet completed, but the other in G——— had succeeded in providing shelter for 130 wounded in the schoolhouse and in adjoining

buildings. Only a few beds being available, most of the wounded had to be laid on straw.

It was no easy task to locate the present whereabouts of our commanding general and his staff; nobody could furnish any information. So we (my assistant and myself) determined to try our luck and resumed our search by automobile. After hours of aimless driving we fortunately meet the staff of one of our divisions and I get an order to inspect the field hospital, which sanitary company No. 1 had erected near G——— and the field hospital No. 3 with its numerous severely wounded. Here we find two small rooms in a private home serving as operating rooms, the necessary hot water being furnished from the adjoining kitchen. The neighboring schoolhouse affords room for forty severely wounded in comfortable beds. The slightly wounded found shelter in the church. Some officers and the surgeons were given quarters in the parsonage. Provisions are good and plentiful and a staff of trained nurses is administering to the needy.

I was ordered back before the approach of darkness would endanger the passage through the forest. Hardly a day passes without the franctireurs being up to some of their cruel, underhand work. I saw victims of their cowardly sniping who had been guarding a provision van. In connection with this affair seventeen inhabitants of L———, including the parson and the mayor of this village, were executed after having been convicted.

Four days later I again visited field hospital No. 3; the work was still being carried on and the number of the wounded had increased to 260. In total 800 wounded were dressed and cared for there, amputations numbering fifteen.

Aug. 25. The enemy is reported retreating and the corps commanders order our advance to S——— for tomorrow. At the dawn of day our troops resume their march and at 2.30 p. m. we cross the French border in sight of S———, the historical battleground of 1870.

Our advance guard is already engaged and our regiments are rushed forward. A fierce battle ensues, which lasts till darkness calls a temporary halt. Long before daybreak our artillery was wheeled into new positions and reopened hostilities with apparently good results. Throughout the whole day both sides kept up incessant firing and the struggle is carried on.

The first temporary surgical quarters are erected right behind the firing line; about a dozen wounded are lying there in the shade of the trees; a surgeon is supervising his assistants in the care of them. Every hour increases the number of the victims; several score of wounded have already been transferred to the village, where the chief surgeon ordered the church and a spacious private house to be turned into

hospitals. Wounded officers are brought in; I dress their fractures with improvised splints and get them ready to be transported.

Outside the battle is still raging; our troops are gaining territory; the Frenchmen retreat to the hills. We erect another field hospital in the captured village of G———, where we find a suitable large building, which formerly was used as a home for the aged. It offers space for 200 wounded, which are taken care of by our Red Cross nurses and sisters.

At nightfall it begins to rain and we receive the order to remove our field hospitals from G——— back to the other side of the river, a measure of precaution. The staff of our division goes the same way. After having crossed the pontoon bridge we proceed in pitchy darkness to a suitable camping site, our supper consisting of a piece of French "zwieback" and a cupful of wine.

The frosty morning brings us some relief and before the battle continues we are glad to grasp that long-wished-for opportunity to change clothes and a chance to wash. Soon our troops advance again and we are compelled to arrange for more wounded.

Late in the afternoon of Aug. 29 our storming infantry breaks down the last resistance of the enemy, who is now in full retreat. We continually press forward and on Sept. 1 we take the fortified French position at the A——— canal, following the enemy over the plateau of C———, break and pierce its line of defense in S—— P—— (Sept. 3) and on Sept. 5 our advance guard reaches the river M——— before V.

During those trying days our corps advanced 100 km. within a week. It was astonishing to note how few of our men reported sick if you consider the scanty rations, which consisted mostly of raw beets or half cooked meat of cattle, slaughtered half an hour before. Cases of gastric diseases were plentiful, but most of the sick made heroic efforts to keep on marching and fighting, in which they usually succeeded by means of large doses of aged French claret.

On the morning of Sept. 3 my auto struck and I had to harness a team of horses to it, which had to be changed in every village. Progress was thus very slow and it was not until I reached S——— P——— (40 km.) that I encountered our staff again. Sanitary Company No. 2 had just completed their work and 280 wounded were lying well taken care of in tents. The staffs of the field hospitals No. 4 and No. 10 had just entered the still burning village to find shelter in some intact barns and farmhouses.

The following day (Sept. 4) brought us plenty of work. In S——— a number of severely wounded were waiting for medical attention. In a hut there I found six Frenchmen: two, shot through the brain, *in extremis;* some with arm and leg wounds, and a poor fellow with burst

open abdomen. All his intestines lay swollen and fibrin-covered in a heap between thorax and upper thigh. He had been wounded on Aug. 31, so he had lain fully four days in this deplorable condition; yet his pulse was fairly strong.

In the police station I found thirty German wounded who had been brought there during the night and now awaited surgical treatment. The majority of their injuries were fractures of the extremities, rifle wounds, also a few shots through chest or abdomen. Luckily we had the necessary dressing material and the appliances for an emergency operation at hand, but we had to improvise splints and paddings. After having finished our work we raised a home-made Red Cross flag to show the returning ambulances where our patients were located.

Sept. 5 saw us in C———, where together with the Surgeon General I was busy hunting suitable locations for our field hospitals. Here we also replenished our medical chests at the drug stores of the city and paid with "Bons." At the fashionable hotel we could not buy a meal as everything had been sold out. By means of some diplomacy, a little bit of French and some money I finally succeeded in obtaining a piece of Camembert cheese and a bottle of wine—a royal dinner for three disciples of Aesculapius.

Meanwhile our troops had advanced to V——— on the M———. That evening at seven o'clock the enemy began to shell our positions and this was the commencement of a five days battle, after which the medical corps were ordered back although our troops held their positions.

As the fighting increased we often were at a loss to know where to place the incoming victims of the battlefield. Soon five field hospitals were in full action and kept ready to be removed on short notice. Our ambulance train, while removing the wounded from the field, was fired upon with shrapnel; nevertheless over 200 patients were brought in and taken care of. The seriousness of the wounds dressed here surpassed everything that I had witnessed so far. At the beginning of the campaign most of the cases were injuries inflicted by rifle shots; here at the Meuse the greater percentage of the wounds were caused by bursting grenades or shrapnel. Although many cases of dum-dum injuries were reported and dum-dum cartridges had been found in a deserted house in V———, I did not have any of these cases to treat.

I soon abandoned the aseptic treatment of wounds which at first seemed practical for the common injuries inflicted by infantry rifles. After painting the wounds with iodine we cleaned them by washing them with a solution of bichloride of mercury and afterwards bound them with a compress saturated with sublimate. Old, dirty or infected wounds I lightly touched with tincture of iodine or cleansed with a weak solution of iodine. The results of these methods, as

far as I could ascertain, have proven highly satisfactory. At that time of the war we only occasionally met with those terrible wound infections such as gas gangrene, etc., which in the latter part of the campaign unfortunately became so numerous. A case of gas gangrene (Aug. 24 in G———), which necessitated an *ex articulatio humeri*, was the only one of that kind for a long period.

Sept. 10 at 1 o'clock in the morning we were alarmed and the order was given to vacate V——— before 8 o'clock because at that time the bridge over the M——— river was ordered to be dynamited. For a short time pandemonium reigned but soon order was restored and at 3 o'clock the last of our ambulances and the last of our men crossed the bridge in safety. We then turned northwards and soon our wagon train catches up with our troops marching in close formation. An awful mixup resulted, which at its best was dangerous, but we had to pass ahead on account of our wounded. Finally we again reach S——— and try to find shelter. Nobody knew where our corps was located and camping.

The next morning we moved our quarters to a house in the city, which overlooked the main street. By chance I detected some of our men passing by and in the evening the whole staff of our commanding general was assembled in the little village of P———, the center of the following engagements. It was here that I was decorated with the Iron Cross by General von T——— in a way which I will always be proud to remember.

In the beginning of the war it was not a hard task to select those wounded who were fit to be transported to the army hospitals located in cities 16–20 km. in the rear of the front, but later on affairs became more complicated through the serious character of the wounds, the scarcity of suitable rooms and the insufficient supply of ambulances.

All our field hospitals sent their wounded back to V———, where the surgical corps of our army had its headquarters and six or seven hospitals received the incoming wounded. These lazarets were improvised in several schoolhouses, in the theater, the hospice and in the large armory. Many of our wounded officers were cared for in private homes.

On the third day (Sept. 21) most of the urgent surgical work was completed and I was ordered to S———, where I had ample opportunity to see the wonderful equipment and perfect organization of our large etappen hospitals. Hardly three weeks after we had taken possession of this town, these hospitals were working with nearly the same apparatus as in times of peace. The X-ray outfit works to perfection, the operating rooms are faultlessly equipped and here the trained Red Cross nurses silently carry on their merciful work as well as in all the

other departments of this great institution. Nearby a field laundry is being opened and nothing is left undone that might add to the welfare and comfort of the patients.

We spent several days in quiet, attending to the wounded, but not for long. Late in the evening on Sept. 25 our army is ordered to attack and the next morning at 4 o'clock the staff of the commanding general follows. At 6 o'clock we hear our batteries on the right wing opening the fight and soon the entire line is heavily engaged. At 8 o'clock the first wounded are brought back. We ask how things were at the front. "We stormed and captured one battery," comes the reply. Soon the first French captives were led by; they tell us that their companies were reduced by casualties from 300 to 130 and 84 men and were under command of a sergeant.

Our troops advance and we establish our surgical headquarters in the village of T——— where the schoolhouse is turned into an operating room. The delirious and the mortally wounded are taken to a low, dilapidated barn. There the army chaplain kneels at the side of a dying soldier, while I try to relieve another sufferer from his terrible pains by an injection of morphine. A second ambulance company arrives and now we have four surgeons at work.

From noon to night without interruption the wounded are brought to our doors and are rapidly selected as to the nature of their injuries. In a rush like this, the field surgeon must try to administer to all. A thorough dressing of the wound and a proper setting of broken or fractured members is the main principle of successful field surgery. It is advisable not to undertake any operations except in most urgent cases. The state of exhaustion in which the wounded is generally found should be sufficient warning to any experienced surgeon. I have seen five wounded who have been operated upon immediately and only one survived; shock, gangrene and sepsis were the causes of the other deaths.

Injuries of the head were only cleansed here, the surrounding hair shaved off, scalp particles cut off and bone splinters removed, but no trepanations attempted. They are left for the operating surgeon at the field hospital. Wounds of the chest with open pneumothorax I fixed with tampons. All injuries of the lungs recover remarkably quickly when kept absolutely quiet with the aid of morphine sulph.

The next morning saw us busy transporting our patients to the field hospital. Whoever was able to walk, walked; others were transported in wagons, and even most of the severely wounded were slowly carried onward in ambulances and automobiles. Soon I returned to my old quarters in M———, where I resumed my work in the four field hospitals there.

CLINICAL NOTES

OBSERVATIONS ON THE EYE, EAR, NOSE AND THROAT WORK AT BASE HOSPITAL NO. 2, FORT BLISS, TEXAS, DURING MOBILIZATION

By Lieutenant Colonel E. M. TALBOT
Medical Corps, U. S. Army

The Eye, Ear, Nose and Throat Clinic at Base Hospital No. 2, Fort Bliss, Texas, during the period I had charge of that service, was a very busy one, as patients were drawn not only from the thousand of troops in the vicinity of El Paso, but also from Mexico and other stations along that section of the border.

The average number of cases treated daily was about one hundred and fifty, nearly equally divided between hospital and out-patients. The latter came with the least formality possible, an informal note or verbal request being all that was necessary to obtain treatment. In fact the only real requisite to receive treatment was that it was required.

In the military service, as in civil practice, the eye is subject to many injuries, often serious, and to many diseases peculiar to the organ. It also shows characteristic lesions in general diseases such as syphilis, arteriosclerosis and chronic interstitial nephritis. I had two cases in which the diagnosis of chronic interstitial nephritis was made from the fundus picture and later confirmed by urine examination. There is no other place where blood vessels can be seen so clearly as in the eye, the virtual image of a direct opthalmoscopic examination magnifying them fourteen times.

Many refractions were made, the object always being to get the best glasses possible for every case, rather than to obtain a great number of prescriptions. In all cases preliminary mydriatic and post-mydriatic examinations were made, followed by the prescription for lenses if required, great care being used, especially in the axes of the cylinders. I can but feel that the care of the eye is often too lightly considered, especially by some of the patients, who so frequently get glasses without consulting a physician.

The most common disease of the eye in our clinic was conjunctivitis, a very large proportion of the cases being caused by the pneumococcus (Group IV). There were hundreds of these cases, the greatest number occurring in December. The usual course is an inflammation of the conjunctiva of one eye, which increases rapidly, so that in six or eight

hours there is a free muco-purulent discharge which often runs over the lower lid and blurs vision. There is a persistent feeling of sand or foreign body in the eye and even boracic acid solution smarts very much when applied. There is general lassitude, but usually no fever. The pneumococcus is found both in smear and culture at this stage, in all cases being of Group IV, as we know, the least virulent. On the second day the lids are more swollen, but the discharge is decidedly diminished. The feeling of a foreign body no longer exists, and boracic acid solution and argyrol give a feeling of comfort. The marked sensitiveness has disappeared and also the pneumococci, which are seldom found on the second day or later if the eye has been properly treated. The inflammation rapidly disappears and the eye is soon normal. However, the other eye is often involved, usually about the third or fourth day.

Some cases of conjunctivitis were caused by the streptococcus, staphylococcus, Kock-Weeks bacillus, Morax-Axenfeldt diplo-bacillus and some by mixed infections. In one case many pneumococci were found the first day, but were absent two days later when the Morax-Axenfeldt diplo-bacillus was discovered.

There were a number of cases of gonorrheal ophthalmia, in only one of which the patient had gonorrheal urethritis. In this case both conditions were probably contracted at the same time. In all of these cases the eyes were saved with perfect results, except two which reached us on the third or fourth day of the disease, after the cornea had practically been destroyed. The great point, of course, is to get these cases early, for with careful treatment the outlook should then be good. When we consider the tremendous number of cases of gonorrhea in a class of men who are often far from careful, we must conclude that there is some immunity which protects the eye. As a rule the eye infection is from some other case. If the patient infects his own eye there is usually a history of some trauma of the organ which lowered its resistance. I remember two cases in my ward at the hospital, Camp Columbia, Cuba, both of which had gonorrheal urethritis and ophthalmia. In one the eye had been recently injured by carbolic acid solution, and in the other by a stick. The soil was prepared. I think a resistance, probably temporary, may exist in patients who have had a pneumococcus conjunctivitis, as I have not known of a single case of pneumonia following this disease.

There were many cases of iritis, both syphilitic and, so-called, rheumatic. The latter I am convinced are not due to rheumatism, but the eye and joint conditions are the result of some focal infection, usually located in the tonsils, teeth or gums.

There were some cases of interstitial and phlyctenular keratitis,

also many corneal ulcers, the simple ones responding easily to treatment and those infected spreading and proving very persistent. In no instance, except the two gonorrheal cases mentioned, was the cornea perforated, but many nebulae or maculae resulted. It is most important to get ulcer cases early so that the cause, if possible, can be removed and treatment commenced.

Most of the pterygria were located to the nasal side, a few to the temporal; some were recurrent, following operations in which they had been cut off. In all our operations the pterygrium was tucked under the conjunctiva unless it was very large, when it was split, part going under the conjunctiva above and part below. The results were excellent.

Besides the cases of albuminuric retinitis cited, most of the lesions of the fundus were choriditis, all of them being diffuse conditions with masses of pigment, except one case of short duration in which the macula lutea of one eye was the only portion involved. There was one patient with a central scotoma caused by an embolism of a branch of the retinal artery, and one with medullated nerve fibers, an unusual but physiological condition.

Injuries of the eye occurred very frequently, in all of which antitetanic serum was administered at once. This is especially important if the eyeball is penetrated. The following cases may be of interest:

Case 1.—A soldier of the Pennsylvania National Guard was sitting in camp with several companions, when one of them threw a cartridge into the fire. Two pieces of metal from the cartridge entered his eye, cutting entirely across the cornea from above downward, passing back through the lens and iris, lodging one, in the posterior wall of the eye, the other in the orbit outside the ball. These were shown by X-ray plates and found later after an enucleation had been performed.

Case 2.—A soldier of the U. S. Infantry was burning rubbish in camp somewhere in Mexico when something exploded which he thought was a cartridge. His eye was severely injured and he was transferred to Base Hospital No. 2. When he arrived at Fort Bliss, there was a healed scleral wound about three-fourths of an inch long on the temporal side. X-ray examination did not show a foreign body, but the eye was enucleated, as it was partially collapsed and absolutely blind. A piece of glass slightly larger than a normal lens was found just back of and attached to the lens. Two other enucleations were performed, one for the gonorrheal ophthalmia mentioned, the other for a marked staphyloma, following an ophthalmia, which occurred months before the soldier joined this station. In all cases as much tissue as possible is left, the recti muscles are carefully secured with catgut and tied to

each other and the conjunctiva closed with a purse-string suture of black silk which also catches the apices of the muscles.

Case 3.—A horseshoer of the 8th U. S. Cavalry while at work had a nail pierce his eye, entering near the cornea-scleral junction. As the nail fell out it pulled a portion of the iris through the wound. An iridectomy was done immediately with perfect results.

Cases 4 and 5.—Each soldier had an eye pierced near the cornea-scleral junction by pieces of glass from exploding bottles. In both cases the iris protruded through the wound, and in both iridectomies were performed with good results.

Case 6.—A militia soldier fell in his tent, a nail catching the inner side of the inner canthus and tearing outward. The wound extended from the lower lid about three-fourths of an inch upward and outward along the upper lid. This was repaired with excellent and really surprising results.

All broken noses (20) have been checked by the X-ray and given antitetanic serum. Satisfactory results have been obtained in these cases.

Many treatments of the nose have been given, the best effects being obtained in cases of sinusitis, especially of the frontal and maxillary, in which 4 per cent cocaine, adrenalin 1 = 1000, followed by a pack of 25 per cent argyrol, gave excellent results.

I have never seen so many cases of otitis media. They follow measles, pneumonia, tonsillitis, pharyngitis, or rhinitis, while others come on suddenly without a history of previous trouble. Many cultures have been taken, most of which show the streptococcus as the cause, some the staphylococcus, others the pneumococcus, Group IV, as in conjunctivitis.

If these cases are seen early, the following treatment will often produce a cure without paracentesis or rupture of the tympanic membrane: Warm 10 per cent phenol in glycerine dropped into the ear at frequent intervals, the head lying on the opposite side; 5 per cent tincture of iodine in glycerine on applicator to the throat behind the posterior pillars over the entrance to the Eustachian tubes, which reduces the swelling and often removes pus and mucus; hot Dobell's or normal saline gargle or nose-and-throat spray, together with rest in bed and free catharsis. If there is much bulging it is better to do a free paracentesis. This is necessary if there is mastoid involvement.

If the ear is discharging, apply the above treatment, using great care to keep the ear clean and to build up the strength of the patient. In other words, help nature as much as possible. Irrigations are not used unless mastoiditis exists. Then add frequent irrigations with

hot boracic acid solution at a low pressure—8 to 12 inches—and constant application of hot, wet, boracic acid pads over the mastoid region. With this procedure most of the cases are cured. Neither the simple nor radical mastoid operation is done as frequently as formerly.

Vaccines, both stock and autogenous, were used in many otitis media and mastoid cases, but their beneficial effects have not been clearly established.

Many tonsillectomies and adenectomies were done under both local (novocain) and general (ether) anesthesia. There is no doubt that infected tonsils cause much general trouble as rheumatism, heart and kidney lesions, but I do not believe that all tonsils should be enucleated any more than that all appendices should be removed.

In conclusion I wish to impress two facts; First, that consultation with specialists should be frequently and early sought, when the most can be done for the patient. An imbedded cinder can be easily removed from the cornea and the eye probably be normal in a day or two. If the cinder is not removed promptly the resultant ulcer may destroy the eye. An acute case of catarrhal otitis media may be cured with comparative ease, while an old suppurating ear with marked destruction of the tympanic membrane is almost hopeless.

Second; the modern trend in eye, ear, nose and throat work is, as in general surgery, towards conservatism. Not so many mastoid operations either simple or radical are done as formerly; all tonsils are not being removed; a slight deviation of the nasal septum does not always require a submucous operation; the sinuses are not opened so frequently and the turbines are not removed because they sometimes swell.

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CORRESPONDENCE

THE MILITARY SURGEON is permitted to publish the following informal official correspondence omitting the name of the reporter, well known to the profession, and of the places reported upon, together with such matters as the censor would delete.

SOMEWHERE IN ENGLAND,
September, 1917.

"My experiences this month have been most varied and seem to include the whole range of British Medical Service, both as physician and patient. As a patient let it suffice to say that no treatment could have been more kind, sympathetic and generous than that which the authorities extended me.

"The General Hospital ——— is a typical British hospital of the base type, receiving the general run of surgical and medical cases of a non-infectious nature. The staff consists of four surgeons and five physicians, with a pathologist and the lieutenant colonel in command. The general rule is to keep patients here until temperatures are normal, wounds fairly clean, and sufficient strength is recovered to stand the channel crossing. I was placed in charge of two surgical wards and the work was most interesting. I was not there, however, long enough to make any observation other than that it seemed to me that wounds treated with B. I. P. paste did not do so well as those treated with some aqueous solution such as saline, Carrel-Dakin solution or eusol.

"The 3d ——— Field Ambulance was running a Corps Rest Station. Hither came the sick and malingering of a part of the corps. A great deal of "trench fever" or, as it is familiarly known, P. U. O. was evident. The malingerers feigned everything from insanity to gonorrhea. One man squirted condensed milk into his urethra to show a discharge which, of course, the microscope detected. Another diligently scrubbed the glans penis with a stiff brush in the darkness of night to produce chancres. He was detected by the orderly. The majority feigned after effects from trench fever. These are similar to influenza or grippe, and, being purely subjective, are difficult to detect when feigned. Many, too, had strained or sprained muscles or joints, the effect of which, being subjective, were hard to estimate. Any man suspected of malingering was kept in bed on a milk diet on a hard and uncomfortable stretcher. This was only done on consultation among ourselves. One feigning deafness was caught by an old trick. After seeing him the medical officer would say, "Poor fellow, he may have a bottle of stout and some chicken for his dinner," this in a very low tone. On the fourth day he complained bitterly because the officer's orders were not carried out.

"The sanitation of this camp is interesting. Frequent baths and changes of clothing were recommended to dispose of the ever-present louse. On admission every man, no matter what his temperature, was compelled to take a hot bath with sulphur soap. Whether the latter was efficient against the louse, I cannot say from my own observation. However, it was much lauded by those who used it. The patient's clothing was stuffed into a pillow-case by the patient,

and this was taken to a Thresh sterilizer and subjected to steam under pressure for thirty minutes. Then the clothes were pressed with a very hot iron and such as needed washing were sent to the laundry. It is found that the eggs of the lice are very resistant, hence the need of pressing.

"Vast quantities of water had to be disposed of. As there were 600 beds in the outfit and daily admissions numbered sometimes as high as 60 but averaged 20, daily bathing and laundry work gave about 9,000 gallons to dispose of. Fortunately 20 feet below the ground surface was a layer of chalk. It was found that three pits 10 feet square and about 20 feet apart dug down to the chalk amply fulfilled the requirements. A certain proportion was evaporated by the cook-ranges and the incinerators, especially greasy cook and dish water. Deep pits also cared for the latrine refuse, they being built so far as patients were concerned over the pits.

"A scabies and impetigo hospital was also established some distance away. As my time was so limited I did not get to this place; it was being run by two medical officers independent of the Corps Rest Station. Sulphur-vapor baths are the most efficient cures for these conditions, I am told.

"The ——— Casualty Clearing Station is being used now almost entirely as a medical hospital and has mostly at present "P. U. O." cases. No treatment has been found as yet that is specific. Like influenza, it runs its course and one can only treat symptoms as they arise. Quinine gr. IV is used for temperatures above 101°, pulv. ipecac, et opii gr. X where suffering is evident. Aspirin gr. XX is used in a single dose daily as an empirical remedy for minor aches. The frequency of the dosage of the quinine and Dover's powder depends on each case's symptoms. A neighboring pathologist is at present doing an interesting search for the microörganism, which he believes is a spirilla, found in the blood during the exacerbations of temperature. He is at present endeavoring to secure the coöperation of a London laboratory which will demonstrate his theories. It seems likely that it is a parasitic disease conveyed largely by the louse."

. . . . . .

Writing from another place and speaking of the functioning of field ambulances, of which there are, normally, three to a division, and which, as is generally known, are divided into tent and transport sections, thus combining in one unit our field hospital and ambulance company, and part of the duty of which is to form the advance dressing station, the observer continues:

"At the A. D. S's the cases are sorted. A second ambulance acted as main corps dressing station. To this come all the slightly or moderately seriously wounded. The gassed cases and "shell-shocked" with no visible wounds, which may be malingering, were forwarded to a special casualty clearing station, which corresponds to our field hospitals, I take it.

"The serious, penetrating wounds of the skull, penetrating chest or abdominal wounds, fractures of the thigh are each referred to a special C. C. S. Why all fractures are not also referred to the last, I cannot say. It seems to me that it would be wise to have such field hospitals equipped with specialists in the individual line of work they take care of.

"The third ambulance runs a rest-and-sick-camp, to which are referred the sick and those who are evidently done through overwork.

"There are several things I observed of a minor nature, which seem to me worthy of consideration. In the first place, our field dressings are white bandages. It is evident that white is a good target. British field dressings are khaki-colored bandages which allow a man, slightly wounded, to return to the line without a visible target attached to him.

The British also have wheel stretchers, which, on good roads in the back area, I should think, might be most useful. They consist of a pair of large wire wheels to which is attached a wooden platform, which has this theoretical disadvantage: If the bearer stumbles or falls for any reason, the stretcher upsets. This could be obviated, it seems to me, by a post attached, and by always seeing that the center of gravity is over the post end, much as a peddler's cart on the east side of New York City.

A third point is that I trust every American ambulance will be well supplied with bandage scissors. They would facilitate work greatly, if the British were as accustomed to them as we are. There also should be, I believe, a hypodermoclysis outfit with each ambulance. Several men could have been saved, I feel sure, who through shock and hemorrhage died on our hands.

When in rest, the ambulance acts as dispensary and field hospital for the sick of a brigade of the division. I have noticed among these there are a great many cases of a superficial infection of the skin and connective tissue, which begin much as furnicle and go on slowly breaking down, involving wider areas. Incision only shows a core of white necrotic tissue without pus. This necrotic tissue separates very slowly, leaving a slow-healing ulcer behind. These infections are frequently multiple, and occur on any surface, except the palms and soles. I find from inquiry that this state of affairs is very common, and the staphylococcus aurius is generally responsible. Why there is so little reaction to the infection remains a mystery to all. It seems to me that about one out of six reporting sick are victims of this peculiar trouble. Whether this malady is solely confined to the British "Tommy" I am not prepared to state, but I am told not. We have been trying the "Scarlet R" ointment lately, but it is too early to draw conclusions.

I suppose one of the greatest pests of summer time is the common house fly. Thanks to the poor domestic arrangement of these Flanders houses, there is always a large manure-pit in the center of the court yard of each farmhouse. In the field no attempt is made to bury horses which are killed. From such breeding places, the fly swarms so thickly as to be an absolute pest. Yet it is surprising to me that there are so few cases of the fly-blown illnesses.

In conclusion I wish to say that possibly these facts are trivial or already known, yet I consider it a part of our function to report what we observe.

AN OBSERVER.

THE
MILITARY SURGEON
VOL. XLII FEBRUARY, 1918 NUMBER 2

ORIGINAL ARTICLES

Authors alone are responsible for the opinions expressed in their contributions

AN EPIDEMIC OF MEASLES AND PNEUMONIA IN THE 31ST DIVISION, CAMP WHEELER, GA.

BY LIEUT. COLONEL LOUIS C. DUNCAN
Division Surgeon Medical Corps, United States Army

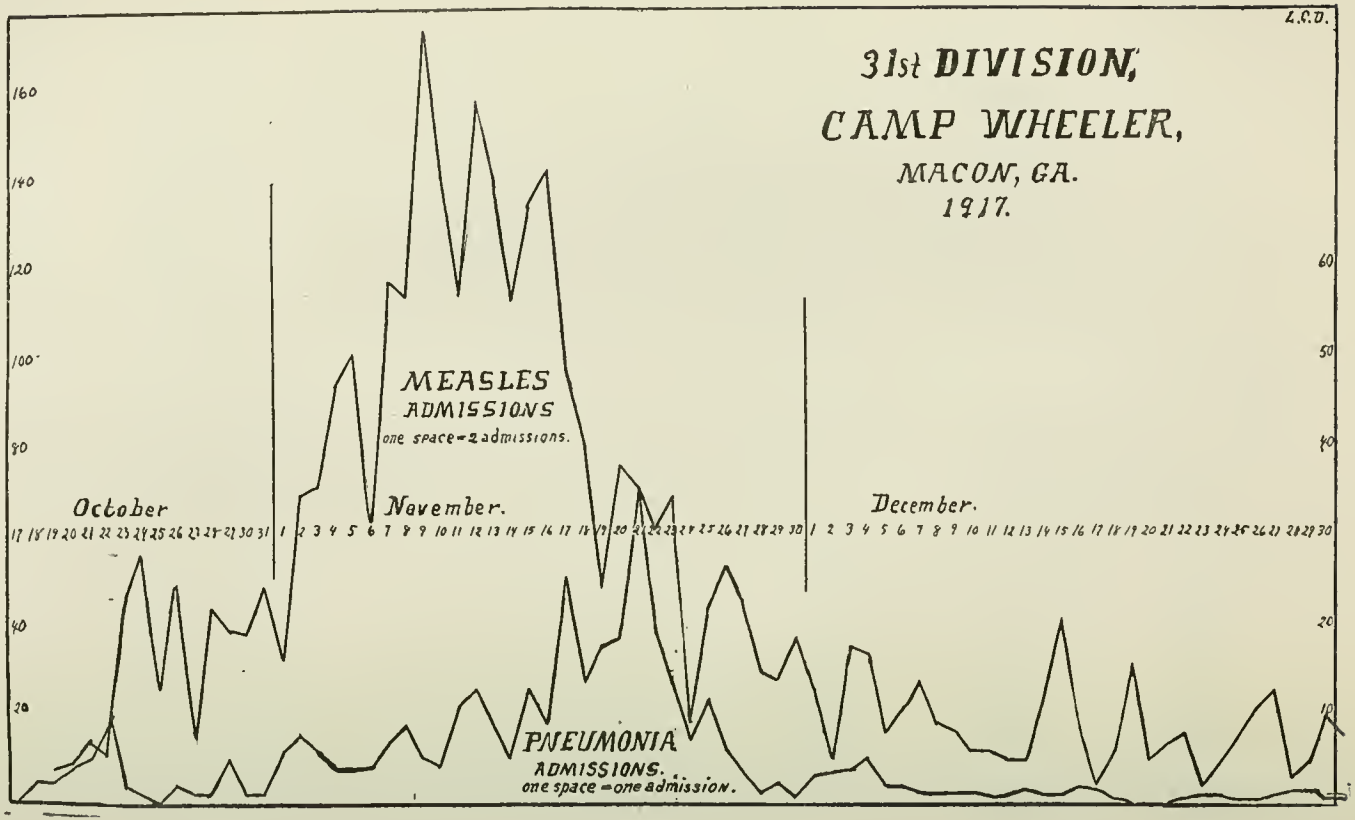
(One chart)

CAMP WHEELER, the camp of the National Guard Troops of Alabama, Georgia and Florida (31st Division National Guard) was opened at Macon, Georgia, on August 25, 1917. This was a real camp, tents being used for the men, and buildings for kitchens, dining rooms, baths, latrines and stables only. The camp was not completed until November. The first troops arrived on September 5 and by September 20 practically all the Militia were here, some 11,000 men. Of these probably 3,000 were recruits of about three months' service; the remainder had been in service more than a year.

Measles had existed in all the regiments from the time of their muster in (June, 1916), and most of the regiments had experienced considerable epidemics of both measles and pneumonia on the border during the winter of 1916-17. The Alabama troops had especially suffered at Nogales, Arizona. Nevertheless with careful measures the incidence of measles was held to a small stationary figure until October 21, when there were but twenty-two cases in the division. The total sick report was then less than 3 per cent. There had been, up to that time, eighteen cases of pneumonia, with no deaths.

On October 14 the first draft men arrived, about 4,000 coming at that time. Others continued to come, until by October 28 over 10,000 had arrived. These draft men brought measles on every train. Cases of measles were taken from trains where they had been shut up in closed cars filled with men for a few hours, or twenty-four hours or more. Six cases of measles were taken from one train.

It can scarcely be wondered at that measles got out of control among these men and among the recruits of the old regiments. The number of admissions for measles, which had been 7 on October 19, rose


A.G.O.
31st DIVISION,
CAMP WHEELER,
MACON, GA.
1917.
MEASLES
ADMISSIONS
one space = 2 admissions.
PNEUMONIA
ADMISSIONS.
one space = one admission.
October
November.
December.
160
140
120
100
80
40
20
60
50
40
20
10

to 14 on the 21st, 44 on the 23d, 70 on November 2, 102 on November 5, 118 on November 7; and reached its maximum with 175 admissions on November 22, 23 on November 25, and 1 on November 30. By December 7 the conflagration had burned entirely out. There were approximately 3,000 cases among the 10,000 draft men. It seems that there were about 30 per cent of non-immunes. This figure is worth remembering. A graphic chart of the measles admission gives a more clear mental picture than any words could. Very many of these cases were marked by severe respiratory complications: bronchitis, pharyngitis, tonsillitis, and laryngitis were extremely common, but there were practically no middle ear or mastoid complications. The one serious sequel was, as always, pneumonia; which grew to such proportions as to absorb all attention and obscure the lesser epidemic of measles with a vastly more serious epidemic of pneumonia.

It was at first thought that the pneumonia was to a considerable extent (70 per cent of cases) independent of measles. Fuller light and close study convinced me that the pneumonia was most intimately connected with the measles and, in fact, dependent on it. I do not see how anyone can study the combined chart of the two diseases, observe how the curve of pneumonia rose and fell regularly, not with but following the measles, and not see a relation of cause and effect.

The epidemic of measles began on October 21; the pneumonia epidemic began ten days later. On November 30, there was one pneumonia admission; on the 2d, 8; on the 8th, 9; on the 11th, 11; on the 15th, 13; on the 19th, 18; on the 20th, 10; and on November 21 the pneumonia epidemic reached its climax with 36 new cases reported. This is probably not exact, since a number of these cases had been admitted on previous days and were then first diagnosed. This was just twelve days after the measles climax; 175 cases on November 9. As with the measles, the decline was rapid. On November 23 there were 35 admissions; on the 26th, 28; on the 27th, 23; on the 30th, 19; on December 4, 17; on the 7th, 14; on the 9th, 8; and on December 12, 5.

The measles epidemic ended on December 7. The pneumonia epidemic may be said to have ended the last of December, 24 days later. The chart will again show the course of the epidemic more closely than any amount of writing. The manner in which the pneumonia curve follows the measles curve is more than accidental.

The causes of this epidemic and of all epidemics of pneumonia are fundamentally two: a predisposing cause, low vitality and an active cause, an infection. More than a year ago I had become convinced that pneumonia was an infectious disease, and when the first cases occurred on October 17, I ordered them isolated from all other cases in the field hospital. Major Loren Greene, 121st Ambulance Co., was then in

charge of the camp hospital. Later developments, such as several cases from one tent (as many as five), the origin of many cases in hospital, and the work of the Rockefeller Institute, have convinced everyone concerned that pneumonia, especially measles pneumonia, is an infectious disease. The infection occurred in many ways, chiefly as follows:

1. Coughing and sneezing, especially in close and crowded places, was no doubt much the most important means of spreading the disease; in tents, in public places, and even in the hospital. In some cases the disease was probably conveyed through an intermediate carrier. An epidemic of coughs, colds and true influenza, preceded the measles, in Macon and later in the camp.

2. Crowding in tents was a contributing cause of infection. By orders nine men had been placed in each pyramidal tent, of 256 square feet floor. There was also crowding in the hospital for a time.

3. Dust may have been a factor in the spread of pneumonia. The camp in October was almost as dusty as the Texas border, the irritation in the throat being generally noticed. That there were some infections from the dust of tent floors is probable, though not proven.

4. Measles was, in my opinion, the greatest single factor in spreading the disease. It was more than a means—it prepared the soil, brought the pnuemonia susceptible together, and the severe bronchial cough of almost every pnuemonia case spread the seed broadcast in the air.

5. Carriers probably developed, though they did not carry the infection long.

The predisposing causes were also inportant; only slightly less so than the actual infective agent; they were:

1. A class of drafted men of most miserable physique, as noticed by all observers.

2. The men from the Gulf Coast did not withstand even the mild winter of central Georgia.

3. Many of the men suffered from the anemia of hookworm or malaria. Hookworm treatment was begun early, but chenopodium could not be procured in sufficient quantities.

4. There was, during November, an undeniable lack of warm clothing. Woolen, underclothes were not secured until the middle of November, overcoats not until later, about December 1. Stoves and fuel were also slow in arriving, as well as heaters for the showers.

5. Personally, I have no doubt there are a certain number of men who are especially susceptible to pneumonia. Measles was the greatest predisposing factor. It lowered the vitality; it caused severe bronchitis, giving the pneumococcus a ready lodgment; it seemed to render men especially susceptible, to produce a sort of anaphylaxis.

Causative Factors. Measles.—The relation of measles to pneu-

monia is shown by the following studies of Major Zinsser and Lieutenant Barker.

1. From the records of the hospital and the regiments, a study of the relationship of measles to the pneumonia cases was made, based on 701 cases of pneumonia and 2,939 cases of measles.

	Per cent
Of 701 pneumonia cases, 389 did not have measles	55.49
and 312 were preceded by measles	44.51
Of the cases without measles 50 died	12.85
Of the cases with measles 93 died	29.8
Total mortality	20.39

Of 2,939 measles cases, 10.6 per cent developed pneumonia.

2. Since December 2 most of the pneumonia cases which have occurred have not had measles as a basis.

3. The chart submitted shows the time relationship of occurrence of measles and pneumonia and of pneumonia based on measles as related to those not based on measles.

4. It was attempted to find out whether or not the measles and pneumonia began in one part of the camp and thence spread gradually to other parts by contiguity. This was found not to be the case. The two diseases occurred in different parts of the camp at about one and the same time, showing thereby that a common factor present at the same time in different parts of the camp had to be considered.

5. The following tabulation shows the relative morbidity of measles and pneumonia and percentage per mean strength by command:

Command	Mean strength	Measles	Pneumonia	Deaths	Pneumonia morbidity	Deaths
					Per cent	*Per cent*
106th Eng.	1,323	202	125	31	9.44	2.34
124th Inf.	2,736	394	170	36	6.21	1.32
123d Inf.	2,402	502	96	19	4.	.79
122d Inf.	2,611	273	46	16	1.76	.61
121st Inf.	2,427	481	73	23	3.01	.97
117th F. A.	1,156	70	22	6	1.90	.52
116th F. A.	1,281	55	28	4	2.24	.32
118th F. A.	1,450	104	37	6	2.55	.41
116th M. G.	510	39	14	0	2.75	0.00
117th M. G.[1]	389	23	20	5	5.14	1.29
118th M. G.	392	24	7	3	1.79	.77
106th Amm.	658	76	13	2	1.98	.3
106th Sup. train.	368	10	6	1	1.63	.27
106th San. train[2]	698	8	6	1	.86	.14

[1] No measles record of 117th M. G. prior to November 1.
8th F. A., did not arrive in camps until November 10.
[2] Two cases not shown on regimental report of Sanitary Train were on duty at base hospital, there developed pneumonia, and both died.

The main points of interest in this tabulation are the facts that there were certain regiments such as the 106th Engineers, the 124th Infantry, and 123d Infantry in which both measles and pneumonia seem to have been particularly concentrated, whereas other regiments adjacent to these were considerably less severely afflicted. It is worth while in this connection to consider the 106th Sanitary Train. This organization consists of 700 men, of whom 320 were National Guardsmen, the remainder being drafted men from Gordon and Pike. In the train there were 180 men from Alabama, 70 from Florida, and 70 from Georgia. As to contact with the sick, 82 of these men were nursing in the base hospital and 270 were occupied as ambulance drivers, in constant contact with the sick. They had only eight cases of measles and six cases of pneumonia.

The chief significant differences between 106th Sanitary Train and others was, as far as I could ascertain, relative isolation of the camp, lack of crowding in quarters, a rather better class, physically and mentally and the fact that they were supervised by 52 medical officers. However, the reason for their relative freedom from illness needs further analysis.

Contact Infections.—The following is quoted from Major Zinsser's report:

One of the purposes of the bacteriological part of our activities here was to attempt to determine in how far the contagiousness of pneumonia from case to case, or from carrier to case, could be based on actual observation at Camp Wheeler. For this purpose it was desirable to make a tent to tent survey of the pneumonia occurring in the various regiments, determining the number of instances in which more than one case had come out of the same tent. The result of this analysis in the 106th Engineers and the 124th Infantry, the two most infected regiments, has been submitted to you in the form of maps. These maps show a considerable number of cases coming from one and the same tent, and this in a company in which many tents furnished no cases whatever. In itself this is very significant, but it should be borne in mind that too sweeping conclusions should not be drawn from this, because type determinations on all of these cases were not available and we have discounted many of the earlier type determinations which showed type four. Also the maps do not discriminate between cases based on measles and those not based on measles, since this information was extremely hard to get at the time these maps were made. Nevertheless, it is a significant fact to be remembered in connection with further facts cited below, that two, three and more cases out of one tent are not uncommon. We thought that more light might be obtained upon the possibilities of contact infection by analyzing, tent by tent, those cases in which careful type determination had been made since our arrival. The results of this were somewhat disappointing, being as follows:

124th Infantry:

Co. A. Five cases. One "type one," one "type two," one streptococcus with influenza, and one "type four" and one "type four" with influenza.
Co. B. One "type four."
Co. C. One "type two" and one streptococcus.
Co. D. One streptococcus.
Co. E. One streptococcus.
Co. F. One streptococcus, one "type four" and one "type one."
Co. G. One "type one."
Co. K. One "type two," one "type three," and streptococcus.
Co. L. Two "type four" not from the same tent.
M. G. One streptococcus.
Hdqrs. One "type four."

A similar analysis of the cases coming from the 121st, the 122d and 123d Infantry during the same period shows a similar scattering throughout the commands without apparent relationship. And though, as a regiment, the 124th showed a good many streptococci and the 123d showed a relatively large number of type two, this does not seem significant since they were scattered in different companies and, for our purposes, the company would appear to be the largest significant unit.

A regiment in which the study of the distribution of cases with regard to types seems to have been more fruitful is the 106th Engineers. In this regiment thirty-six cases occurred during the first sixteen days of December, on which type determinations could be made. A few of these cases were scattered in the headquarters company and the medical detachment, but the others fell into company groups and showed the following interesting condition.

Company A had seven cases, four of which were type one. Company B had six cases, four of which were type one and one of type two. Company C had five cases, three of which were type four. Company E had seven cases, four of which were type one, three of which were type two. Company F had six cases, three of which were type two and two of which type one; one did not develop an organism in the mouse.

The large number of similar types obtained from the same companies, during a short period, with a high pneumonia morbidity, was so striking that it seems worth while to further investigate tent distribution. Before describing this, however, it is worth mentioning that, from our observations on the close company associations of men in camp, the tent association is believed to be not much more important than company association, since the men, even if they do not sleep together, are constantly in touch with each other in company streets and at mess.

Nevertheless, the tent study was made and it was found that only in Company E were any of the cases with similar types associated in the same tent. In this company there were two men, both type one, in one tent, and three men, one a typical type two, a type two and a type one in the same tent. Two others,

one a type one, the other a type two, were the only sick in their respective tents.

Since we still had a number of mice left, we thought it would be interesting to take twenty-five men from Company E who had not been sick, if possible, tent-mates or associates of the sick, and determine whether they were carriers of organisms similar to those which had caused the pneumonia in their company mates. This was done and the following interesting results obtained:

Of the twenty-five individuals so examined (we do not call them healthy because a good many of them had colds and coughs), one was a carrier of type one, one was a carrier of type two, two were carriers of a typical type two, one had streptococcus and influenza bacilli, two had streptococci, and the rest had either type four or showed no growth in the mouse.

It is further interesting to note that the type one carrier was in the same tent with one of the type one pneumonias and two of the type two pneumonias, and that the type two carrier was probably in the tent with one of the type two pneumonias, although this last information is somewhat uncertain, being elicited by questioning the men in the company street, but not on record.

This summary of Company E, during the short period of intense outbreak, furnishes some evidence of the probability that contact and carriers played a definite part in the transmission of the disease.

Relation of pneumonia to length of service is shown by the following table:

1 month	75	8 months	13
2 months	174	9 months	3
3 months	185	10 months	1
4 months	48	1–2 years	34
5 months	30	2–3 years	6
6 months	52	3–4 years	2
7 months	60	7 years	1
Total under 8 months	624	Total 8 months and over	60

The relation of pneumonia to age is not so definitely shown, nor could it be, in that the number of all soldiers of the various ages is unknown. It appears that, after 25, susceptibility to pneumonia grows less.

The numbers of patients of various ages were as follows:

16 years	1	26 years	28
17 years	2	27 years	23
18 years	32	28 years	16
19 years	37	29 years	11
20 years	24	30 years	20
21 years	96	31 years	3
22 years	106	34 years	2
23 years	94	35 years	2
24 years	60	38 years	2
25 years	54	40 years	1

As stated in the beginning, the soldiers of the 31st Division came from Alabama, Georgia and Florida. It was the general impression that the men from Florida suffered much more than the men from the other two states, due to the fact that they had made a considerable change of climate in coming to central Georgia. This change of climate might partly explain the greater prevalence of pneumonia in soldiers from the southern states.

The numbers of cases and states in which patients enlisted were as follows:

Florida	277	Pennsylvania	3	New York	2	Ohio	1
Georgia	178	Arkansas	2	South Carolina	2	Oklahoma	1
Alabama	172	Indiana	2	Missouri	1	Tennessee	1

This table does not show the real excess of pneumonia in the Florida troops; for, Florida has a smaller population than the other states and furnished little more than half as many men as Alabama or Georgia.

It was believed that the drafted men suffered more severely than the volunteers. This was true, but hardly in the proportion expected, while the numbers of these two classes were about equal, there were 273 cases among the volunteers and 391 cases among the drafted men. The proportion was 2½ per cent in the volunteers and 3½ per cent in the drafted men. The length of service was the real factor, of course, not the draft.

The number of men by states and by enlistment or draft was:

	N. G.	*Draft*	*Total*
Alabama	2,608	5,007	7,615
Georgia	5,067	4,100	9,167
Florida	3,316	1,412	4,728
Total	10,991	10,519	21,510

Florida had 277 cases among 4,728 men, or 5.9 per cent of command.

Alabama had 172 cases among 7,615 men, or 2.2 per cent of command.

Georgia had 178 cases among 9,167 men, or 1.9 per cent of command.

Preventive Measures.—The steady increase in the amount of pneumonia, and especially the increase in the number of deaths, with the numerous funeral processions through the streets of Macon, compelled, if compulsion were necessary, a united effort to search out and, if possible, find some means by which this fatal epidemic could be combatted. Gradually, aided by the Surgeon General, Colonel Fisher, Major Zinsser and the Sanitary Inspector, Major Turck, means were found which have at least greatly reduced the amount of pneumonia in the division. General Hayden was also of the greatest assistance. These means were as follows:

1. A sufficient amount of woolen clothes, including overcoats and blankets, was secured.

2. Through the effective action of the Surgeon General sufficient tents were secured to place but five men in a tent, allowing 50 square feet of floor space per man.

3. Greater efforts were made to secure systematic furling of tents, and the keeping open of tent hoods and doors at night. A sentry was placed in each company street to enforce this order.

4. Tent floors were required to be mopped out daily with a 2 per cent creolin solution. Spit boxes, filled with sand wet with creolin solution and emptied daily, were required in each tent.

5. Mess kits were required to be boiled and the use of dish rags was not allowed.

6. Careful supervision of dental work was required, with sterilization of instruments by boiling.

7. Sterilizing rooms were constructed at the base hospitals and in all infirmaries, for sterilization of effects of pneumonia patients. Formalin and phenol were used in these.

8. Pneumonia convalescents were segregated and not returned to regiments, but later sent to Fort McPherson hospital.

9. The spraying of throats of convalescents with dichloramine T was required.

10. Measles patients were separated by screens in the hospital, and retained for a much longer time than previously.

11. From an early date, pneumonia patients were segregated in the base hospital and the types, as far as possible, separated, measles pneumonia being isolated from independent pneumonia.

12. Sprinklers were secured and a general system of road sprinkling was instituted, though at rather a late date.

13. The stopping of all gatherings was considered long and carefully, but never adopted.

14. Prophylactic vaccination was advised by me, as an experiment, but has not yet been tried.

Conclusions

1. Pneumonia is *the* disease of the camps of 1917-18. It occupies relatively the same place that typhoid did in the camps of 1898. It is killing hundreds and will render the morbidity and mortality rates of the Army little better than they were in that year. No other disease (except measles as a feeder to pneumonia) is of any importance compared with this captain of the men of death. Twenty per cent die (30 per cent of the measles pneumonia); at least 10 per cent more will have to be discharged; from two to three months are lost by each patient.

Moreover, the hospitals are filled with sick who require the utmost of nursing, care, and medical attention.

2. For some reason not understood, the autumn of 1917 was peculiarly favorable to the development of pneumonia.

3. There is a large number of young men of military age, especially in the Gulf States, who are very susceptible to pneumonia. Poor physique, hookworm and malaria increase this susceptibility.

4. In addition to the above, attacks of measles and grip made many men susceptible and increased the susceptibility of others.

5. Pneumonia, like any other germ disease, is infectious. Coughing is the principal means of spread. All pneumonia patients should be segregated at once and kept segregated until no longer carriers of the germ. Practically the same sanitary measures are necessary as for meningitis.

6. When recruits from the southern states are mobilized in the summer time, it is advisable to allow measles to spread until all have had it. In the winter time measles will probably spread in any event.

7. Crowding of recruits is one of the most fruitful causes of spread. Overcoats are cheaper than coffins. Lumber is cheaper than lives.

8. The separation of pneumonia into types promises advances in treatment and prevention. It can hardly be said that it has actually accomplished much as yet.

9. The records do not show any marked advance in the treatment of pneumonia. The mortality is still 20 per cent as it was fifty years ago.

10. A prophylactic vaccination is highly desirable. It would save almost as many lives as has the typhoid prophylactic.

APPENDIX A

REPORT ON TREATMENT OF PNEUMONIA IN THE BASE HOSPITAL, CAMP WHEELER, GA.

Addendum to the Report of Lieut. Col. Louis C. Duncan, M. C., U. S. A.

By Major JOSEPH SAILER

Medical Reserve Corps, United States Army

The eight hundred cases of pneumonia that have been under treatment in the base hospital, have presented a variety of types and complications. This has necessitated the employment of methods that are more or less individual, nevertheless certain general principles have been followed, varying more or less according to the differing views of the successive chiefs of the medical staff.

On the whole it may be said that the care was better than the inadequate facilities would have seemed to render likely. These deficiencies

were: the impossibility of heating the wards properly; the absence of plumbing; the difficulty of serving the food reasonably warm; the limitation of the supply of drugs; the untrained state of the orderlies when the epidemic commenced; the extreme over-crowding of the hospital, that has rarely had less than twice as many as it was built to accommodate, and sometimes more than thrice as many. Although there has been some improvement, the hospital is still inadequate to the needs of its patients. Undoubtedly, especially in the cases following measles, the prognosis was rendered less favorable by the unavoidable exposure to cold.

The treatment can best be considered under four heads: (1) specific treatment; (2) non-specific general treatment; (3) treatment of collapse and medical complications; (4) discovery and surgical treatment of empyema.

1. Only one form of specific treatment has been employed, the anti-pneumococcic serum for type one of the pneumococcic infection. This has been employed in about forty cases in which it was possible to obtain type determinations, and in eight cases in which type determinations were not made on account of the scarcity of mice. In the forty determined cases the mortality was about 10 per cent, slightly less than in the cases not preceded by measles, but not enough to convince us that the serum had any distinct curative effect. Aside from a few mild cases of serum disease, no injurious results were observed and, as a general rule, the temperature was lowered temporarily and the patient apparently benefited. It is justifiable to conclude that the serum is harmless, but there is, we believe, in this series no proof that it is specific. The eight cases without type determinations are interesting because the serum was used only when they appeared desperately ill and in the state called toxic. The serum was employed only because all other treatment had seemed ineffectual. All improved immediately after the injection and have continued to improve. Efforts have since been made to determine the type in these cases, but as yet unsuccessfully.

2. Under Major Weil all cases of pneumonia were given moderate doses of digitalis and tincture of nux vomica, about ten minims of each, three times daily. Under Major Halsey they were treated by large doses of digitalis according to the method of Cohn, about half a drahm being given three times daily until three or four drahms had been administered; it was then discontinued until signs of auricular fibrilation should appear, when the addition of a small amount of digitalis would control this condition. Under Major Sailer ward surgeons were permitted to use any rational treatment, and practically all used small amounts of strychnine and some saline expectorant, such as ammonium

chloride. Codeine has been used throughout the epidemic to control pain and cough, and adhesive straps in those cases in which pleurisy was found or strongly suspected—a large proportion. Laxatives have been used moderately when indicated, not as a routine treatment.

3. The treatment of collapse and unfavorable complications has been vigorous, no case being regarded as hopeless until death occurred. The most common serious event has been edema of the lungs. This has been uniformly treated with large doses of atropine, occasionally as much as 1-50 of a grain being given hypodermically every hour. No instance of distinct physiological action of the drug has been observed, excepting the control of the edema, there has been no dilatation of the pupil, and rarely a slight sensation of dryness in the mouth . . . smaller doses have been continued for days. The rule has been to control the edema, if possible, no matter how much was required. Apparently some lives have been saved, and there has been no evidence of an injurious effect. The absence of a physiological response has led us to suspect that vagotonia plays a part in pulmonary edema. Next in frequency has been circulatory failure; this has been manifested in two ways, either as cyanosis or as a weak pulse and muttering delirium, the so-called toxic state. The treatment differed; for cyanosis with dilated right heart, venesection has been uniformly employed, sometimes assisted by a dry cupping. The effect has been prompt and decided. Temporary or permanent improvement has always followed and has been unmistakable. Morphine has also helped these cases.

For the second group, at first stimulation was employed, chiefly camphor, strychnine, caffeine and digitalis. There were no permanent results; all these cases died. Later proctoclysis with sodium bicarbonate and, when it could be obtained, glucose solution, were used, and seemed occasionally helpful. Hypodermoclysis was tried once, but did not seem to help. The case was desperate. Finally it was decided to use the serum and this has seemed, in eight cases, an efficient remedy. We shall continue to use it until a definite conclusion has been reached. In the type determined cases the serum was always used before the toxic state developed. The fatalities were due to other causes in these cases.

Prolonged delirium—that is, lasting more than three days—has been treated by spinal puncture; this has been satisfactory. There have been no unfavorable results.

Rarely the odor of acetone has been detected upon the breath. Owing to the deficiencies of the clinical laboratory, it has not been possible to test for ketonuria. For this condition sodium bicarbonate has been administered, without producing very definite results. The

installation of ward laboratories will, it is hoped, render the detection of this condition more certain. Among the special surgical complications may be noted four cases of intramuscular abscess, one in the upper segment of the rectus, two in the lower segment of the rectus, and one in the gluteal muscle; all required incision, healed without incident, and the pneumococcus was found in the pus. Otitis media occasionally occurred and the course was mild.

There were several cases of pneumococcic meningitis, of which two recovered. The treatment was spinal puncture, and in two cases, known to be type one, the intraspinal injection of anti-pneumococcic serum; neither of these recovered, but were not apparently made worse by the injection. These will be made the subject of a separate report.

4. The management of the post pneumonic empyemas has been the most difficult problem presented by the pneumonia cases. It was soon determined that, if we relied wholly upon the physical signs, many of the cases would be overlooked, and gradually the following working system was evolved that has been fairly satisfactory, although not by any means perfect.

The pneumonia patients are divided into two classes, the suspicious and the non-suspicious. The former are reported daily and are subjected to a special examination, not only by the ward surgeon but also by a medical inspector or myself. The following features render a case suspicious; first, duration of fever for more than ten days; second, intermittent fever; third, return of fever after crisis or lysis; fourth, appearance of the physical signs of fluid; fifth, persistence of the physical signs of consolidation; sixth, localized distension of the cutaneous veins of the thorax.

On account of the inadequate equipment and personnel of the clinical laboratory, it was impossible to obtain daily leucocyte counts. A sudden rise in the leucocytes, could it have been determined, would be regarded as a suspicious sign.

If upon examination there seemed to be any sufficient reason, the patient was examined by the X-ray, either with the fluoroscope or by a plate, or both. If the suspicion were apparently confirmed, or a reasonable doubt existed, exploratory puncture was immediately done. The technique of the puncture was made as perfect as possible, the utmost cleanliness was observed, multiple punctures were not made on the same day, and after the needle was inserted it was not permitted to move the point about in the thorax. There have been no accidents. Every effort was made to discover or exclude the presence of pus in each case on the day that the case was first reported as suspicious

but this was not always possible, and in several cases pus was found after three or four days. From the considerable amounts of pus found at operation, it was concluded, either that we are unable to detect small amounts or that the pus accumulates very rapidly. Probably both are correct. As soon as pus was found the patient was transferred to the surgical department for operation, often directly to the operating room. Altogether forty-five cases have had operation, of whom sixteen have died and one was returned to duty; twenty-eight are still under treatment. The high mortality has caused us much anxiety, and the surgeons are coöperating vigorously with us to discover the cause or causes and to overcome them. In addition four cases have been discovered at autopsy that had been missed, and two cases were in such desperate condition that no operation was attempted, and they died unrelieved. Altogether about 7 per cent of our cases of pneumonia have developed empyema, of whom nearly one-half have died, a very large proportion.

The most important factor in discovery of the empyemas has been the persistent alertness of the whole medical staff.

In a number of cases, not yet collated, clear fluid was found; this was always aspirated and, although a few of these cases subsequently developed empyema, so many recovered without operation that we are satisfied that this is good practice.

It may be interesting to note that three cases of pneumonia subsequently developed meningitis of the epidemic (meningicoccic) type. This is unusual and is now the subject of a special investigation by Captain Wilson, the director of the laboratory.

There were four cases of digitalis heart block, all of whom recovered promptly, and no cases of arythmia that might have suggested auricular fibrilation.

The management of the convalescent patients has been a most difficult problem. The overcrowded condition of the wards made it necessary to discharge patients somewhat earlier than is usual, particularly during the epidemic of measles and mumps. Unquestionably this has been injurious and helped to increase the incidence of pneumonia. The convalescent pneumonias presented another problem. They were not able to return to duty nor were there suitable quarters in the hospital for their care. The difficulty was finally solved by transferring them to the hospital at Fort McPherson. This transfer is proceeding steadily. The results appear to be favorable, but cannot yet be finally determined.

January 1, 1918.

APPENDIX B

Division Surgeon's Office.
Headquarters Thirty-first Division.
Camp Wheeler, Ga.

Circular No. 12. *December 4*, 1917.

PNEUMONIA

Pneumonia is an infectious disease, conveyed by means of saliva and mucus from the respiratory organs. The disease may be communicated directly by contact, indirectly by a carrier, or by dust containing the cocci. The following measures are to be carried out:

1. The surgeon should see that all regulations for the ventilation of tents by keeping hoods and doors open are enforced.

2. The floors must be scrubbed daily, with 2 per cent creolin, or its equivalent, when possible. No dry sweeping should be allowed.

3. Spit boxes must be kept in all tents, containing sand wet with creolin solution, and emptied daily. The company streets must also be kept clean.

4. The tents must be furled on all clear days, and kept furled for not less than six hours.

5. Not more than five men are allowed in a tent, and the heads of the men must be as far apart as possible, 5 feet being the minimum.

6. The surgeon should keep a record of all cases of pneumonia and a plot showing the location by tents. Infected tents should be given special attention. Names of patients may be procured at the Division Surgeon's office.

7. Bedding and clothing of measles and pneumonia patients will be disinfected as soon as disinfecting rooms are ready at the infirmaries. Beds should be sunned well.

8. Chenopodium will be given all men who have not yet had it.

Louis C. Duncan,
Lieut. Col., Med. Corps, Division Surgeon.

THE DISPOSITION OF PATIENTS AND CANDIDATES FOR ENLISTMENT WHO PRESENT SYMPTOMS AND SIGNS OF HEART DISEASE

By Major JOHN M. SWAN
Medical Reserve Corps, United States Army

THE determination of the efficiency for military duty of men who present the subjective symptoms and physical signs of the various forms of cardiac disease is no easy matter. Recruiting officers are often unable to decide whether a candidate who presents a murmur will or will not be able to stand the strain of active service, and ward surgeons are often unable to decide whether a patient who complains of cardiac symptoms is complaining on account of a functional disturbance or because of serious organic disease.

During the Civil War, Da Costa, to his own satisfaction and that of nearly everybody else, described the irritable heart of soldiers as a clinical entity and showed that its treatment by digitalis was satisfactory. During the present war, the question of the interpretation of cardiac signs and symptoms has been prominent; so prominent, in fact, that it has been thought wise by the Medical Research Committee, working under the direction of the National Health Insurance of Great Britain, to devote special attention to the cases of soldiers returned as cases of "Disordered Action of the Heart" (D. A. H.), or "Valvular Disease of the Heart" (V. D. H.). For the purpose of the study and treatment of these cases, a military hospital (Hampstead) was set aside and a staff of specially trained observers assigned to it in order "to provide for the invaliding out of the service of men with permanent disease unfitting them for further duty and for the treatment by appropriate means of a very large group of cases of uncertain nature."

The following are the important symptoms of which these patients complain: breathlessness, pain, exhaustion, giddiness and fainting. Breathlessness is often constant and is increased by exercise or by emotion; sometimes it is experienced while at rest and occasionally it is paroxysmal. Pain is frequent and varies in degree from precordial discomfort to that suggestive of true angina. Giddiness is almost constant and is associated with change of posture and with effort. Palpitation of the heart, headache, lassitude, excessive sweating, coldness of the hands and feet, irritability of temper, sleeplessness, inability to fix the attention, shakiness and flushing are less important symptoms. The physical signs include increased heart rate, an exaggerated response of the systolic blood pressure to emotion and to effort, deficiency of

force of the apex beat, irregularity of the heart's action, occasional slight rises of temperature, increased respiratory rate, hyperacidity of the urine, with the presence of phosphates and calcium oxalate crystals, and a moderate leukocytosis chiefly affecting the lymphocytes.

The report made for the active staff of this hospital, by Dr. Thomas Lewis, is the basis of this paper. It summarizes the careful study of about 1,000 soldiers. When these soldiers were received at the hospital they were first passed through a preliminary sorting and were divided into two groups: (1) those who were unfit for further service, and (2) those who required more careful study.

Those unfit for further service include cases in which the symptoms are due to the existence of pulmonary tuberculosis or frank exophthalmic goiter; those in which there are unmistakable signs of mitral stenosis, aortic regurgitation, aneurysm, grave forms of cardiac irregularity, and cases in which there is an appreciable displacement of the heart's apex to the left.

The opinion expressed in this report concerning the value of cardiac murmurs in the determination of the fitness of a soldier for duty is worthy of reproduction. The report says, "Auscultation is the least valuable method employed in sorting soldiers suffering from cardiovascular derangements. The sorting can almost always be effected without its aid." The characteristic, low-pitched, rumbling, presystolic murmur at the apex and the diastolic murmur heard with maximum intensity at the base of the heart and associated with a water-hammer pulse are indicative of mitral stenosis and aortic regurgitation respectively. Systolic murmurs, on the other hand, whether heard at the base or at the apex, in the absence of other disqualifying signs, may be entirely neglected. These murmurs, in the experience of this committee, indicate valvular disease exceptionally. The extent of mitral valve damage sufficient to produce a systolic murmur is relatively slight. The disease is often limited to the valve; the heart muscle, which is the essential part of the organ, being wholly undamaged. Patients who are invalided on the ground of systolic murmurs alone are found, when tested, to be fit for active service in nearly all instances. A large number of men who present such murmurs are known to have passed the more severe ordeals of active service without accident. At the same time, if a group of patients who present no murmurs and a similar group in whom systolic murmurs exist are tested in respect of their capacity for work or active service, no difference will be found in the two groups.

As a result of this study, the committee finds that an appreciable increase of dulness to the left of the sternum and a strong impulse beyond the nipple line are the most satisfactory guides to enlargement of the heart.

Intermittence of the pulse or simple and regular groupings of pulse beats (respiratory arrhythmia) should not be interpreted as physical signs of heart disease; they would not incapacitate the person in whom they exist. "The only irregularity of consequence in soldiers is a persistent irregularity of a very disorderly type which does not disappear when the heart is accelerated during or immediately after exercise" (auricular fibrillation).

The following statements seem to the writer to be so important that they are quoted at length:

> The fear of overlooking early heart disease and the widely felt difficulty of its diagnosis are chiefly responsible for hesitancy in dealing with the men, and for blunders in classing them for duty and discharge. Here, again, actual experience is the only safe guide. It may be taken as an axiom that no soldier who is free from symptoms on duty, has an affection of the heart which incapacitates him, and this axiom may be adopted irrespective of any unusual sign found in the heart. Now actual heart disease in young soldiers, in the absence of a history of rheumatic fever or of syphilis, is a comparative rarity. Where there is a history of rheumatic fever, and especially when symptoms date from rheumatic fever, the question of diagnosing a heart lesion need only rarely arise; for, whether it exists or not, the history and symptoms alone will almost always declare incapacity; it is a matter of experience that these men rarely return to active service and, if there is return, the subsequent stays in hospital will very greatly outweigh the duration of duty performed. In regard to syphilis, it is remarkable that amongst those who exhibit signs and symptoms of the syndrome considered, a history of syphilis or a positive complement fixation test is very rare. Venereal disease generally, like alcoholism, is conspicuous by its absence from the histories of these soldiers. When the first sorting has been accomplished upon the lines indicated, any further attempt to diagnose organic disease of valves or muscle should not be attempted for, if attempted, it will in the best of hands prove unprofitable; in inexpert hands it will often prove disastrous.

After eliminating the patients received in hospitals who present conditions described in the preceding paragraph, a second sorting is made of the patients and the following are marked as unfit for duty of any except the sedentary type: (1) Those in whom the onset of the symptoms dates from the occurrence of an attack of rheumatic fever, or in whom there have been recurrent attacks of rheumatic fever. In this class of cases, of course, a distinction must be made between genuine acute articular rheumatism and attacks of joint and muscular pain, not due to acute rheumatism. (2) Those in whom dyspnea on exertion has been tested objectively and found to be persistently severe. (3) Those in whom precordial pain repeatedly prevents exercise and is associated with hyperalgesia of the cardiac skin areas. (4) Those in whom the heart rate is persistently 120 and over, even when lying down. (5)

Those in whom an exercise test such as walking up a flight of thirty steps produces an anxious expression, a respiratory rate of thirty-five or more, which does not disappear when the patient lies down, or a pulse rate which fails to fall within five beats of the preexercise level after lying down for two minutes. (6) Those in whom the symptoms are of moderate severity, but of many year's duration. This class includes men who gave up games at school or left heavy work in civil life on account of symptoms.

The cases remaining after the exclusion of those indicated above are then tested out by means of graded exercises. The report gives five sets of calisthenic exercises, beginning with very mild movements lasting fifteen minutes, gradually increasing until a group of energetic movements lasting thirty minutes is employed. When sorting the patients by this method, it is wise, in speaking in their presence, not to use terms which would draw attention to the heart. All such terms as valvular heart disease, disordered action of the heart, soldier's heart, athlete's heart, heart strain, and irritable heart should be carefully avoided. The term "effort syndrome" is suggested as being a satisfactory designation for the patients under consideration.

The exercises referred to above may be given without fear of ill consequences. The same exercises that are used for sorting the cases are also employed therapeutically. Rest in bed is harmful and should be avoided, except in cases attended with severe precordial pain, severe headache or severe giddiness.

Continual rest in bed is undesirable in any circumstances. The inclination of many of these soldiers is to stay in bed; it should be discouraged. Many are of neurotic temperament and self-abuse is by no means unknown amongst them. Occupation is clearly called for, not only upon this ground, but on the wider ground that it controls introspection which is prevalent. Briefly, these soldiers should be treated primarily as convalescents; they should be encouraged to stay much in the open air and should be given light employments, such as gardening; they should be given to understand not only that their condition is curable, but that improvement is visible. At the first interview, there should be no lingering over the examination of the heart; in no instance should any suggestion be made that the heart is in any way affected. Much good can be accomplished by stating, wherever possible, as each organ is examined, that it is sound.

It has been clearly shown that tobacco increases the resting pulse rate and exaggerates the rise of pulse rate and symptoms induced by exercise in these patients. A number of drugs have been shown, by carefully controlled observation, to be without material effect upon the condition. Digitalis is without influence upon the symptoms, and its use should be discarded; the only soldiers in whom this drug has a real value are unfit

to remain in the service. Bromides may be of service in the initial stages; in the later stages they are of no avail.

The most successful methods at present available are the well-known hygienic methods and graduated exercise. Exercises have been adopted at many hospitals in England, and with very gratifying results. They serve the double purpose of sorting doubtful cases into several categories for service and improving the capacity for work.

To one familiar with the various manifestations of disturbance of the endocrin system, the symptoms and physical signs, manifested by those patients who are not excluded as suffering from organic heart disease, must suggest that the condition so long known as "the irritable heart of soldiers" and now to be called, if the recommendations of this very able committee are adopted, "effort syndrome," is dependent upon disturbance of the thyroid or other ductless glands. The committee has considered this possibility and has discarded it. They say that the onus of proof rests with those who put forward this hypothesis. In 483 of their cases the thyroid gland showed no enlargement; in nineteen cases there was some demonstrable enlargement; in fifteen, the enlargement was doubtful. They do not consider that rapid heart action, palpitation, flushing, tremor and moist skin are sufficient to warrant the conclusion that the endocrin system is affected, because the same signs are frequently present in convalescents from acute infections. They say, "the question of hyperthyroidism is capable of a direct test, namely, the tolerance or intolerance of these patients to thyroid administration. A large number of observations have been conducted from this point of view and others are in progress. So far as they have been taken, they are opposed to the view that there is an unusual tolerance to the extract of thyroid."

They also consider the possibility of the condition being dependent upon myocardial disease. They conclude that "while the possible presence of early myocardial change in certain of these patients remains undecided and is even deemed probable, it is very improbable that such lesions play much part in producing the symptoms in the group as a whole." They also discard the hypothesis of a bacteremia and of toxemia as the cause of the condition, although it is possible that both of these conditions may be coexistent.

One of the first considerations in the treatment of these cases is the removal of foci of local infection—the extraction of carious teeth, the removal of septic tonsils, the cleansing of the mouth by antiseptic washes, and the removal of a chronically inflamed appendix. I would suggest the following conclusions for the guidance of recruiting officers and ward surgeons: (1) A candidate for enlistment who presents definite

evidence of mitral stenosis, aortic regurgitation, aneurysm or hypertrophy of the heart should be rejected. (2) A candidate who presents an apex systolic murmur, transmitted into the axilla and heard at the angle of the scapula, accompanied by definite evidence of cardiac hypertrophy and subjective symptoms, should be rejected. (3) A candidate who presents an apex or a basal systolic murmur of irregular transmission, not accompanied with cardiac hypertrophy, and unattended, except occasionally, with subjective symptoms, should be accepted. It is altogether likely that such a candidate, under regular out-of-doors life with systematic muscular exercise, would prove satisfactory material for the development of a good soldier. (4) A candidate who presents an extra-systolic arrhythmia or a respiratory arrhythmia should be accepted, provided there is no evidence of organic heart disease. (5) A candidate who presents a pulsus irregularis perpetuus (auricular fibrillation) should be rejected. (6) Cases of functional cardiac disease which have, in the past, been termed irritable heart of soldiers, etc., should not be treated as cardiac cases. They should not receive digitalis. They should not be kept in bed. They should be employed at tasks which require a gradually increasing expenditure of muscular effort. Calisthenics should form a part of their treatment. (7) Candidates for enlistment who give a history of syphilis and of recurring attacks of rheumatic fever should be rejected.

THE EFFECTS OF HIGH ALTITUDES UPON THE EFFICIENCY OF AVIATORS

By Major E. G. SEIBERT

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IT IS a well-established fact that pilots show marked evidences of nerve breakdown or instability in greater or less time, according to the individual. Earlier in the war this was attributed to the stress of circumstance. Observation, however, developed the fact that there was a more potent underlying cause, which, by a great amount of patient investigation, was shown to be largely due to the decreased quantity of oxygen going into the blood.

As the war progressed, the altitudes to which pilots were forced to go became greater and greater, and these evidences became progressively more and more pronounced. Today, altitudes are commonly reached on the fighting front which were, before the war began, only rarely attained. Now, because of the increased range of anti-aircraft guns, altitudes of 20,000 feet and over are necessary for much of the fighting and scouting, and are commonly reached in the day's work.

Inasmuch as the reasons why these evidences of nerve instability are a matter of altered physiology, it may be well, before further discussing the subject, to call attention to some of the fundamental facts of the physiology of respiration.

The term *respiration* is usually applied to the intake and output of air from the lungs. As a matter of fact, however, respiration further implies the gaseous interchange in that terminal portion of the bronchial tree known as the air cells or alveoli; the taking up of oxygen into the blood in loose combination with the hemoglobin; the carrying of the oxyhemoglobin to the peripheral tissues and giving up oxygen to oxidize or burn up muscular and other tissues, furnishing heat and power, and giving to all the body processes those phenomena which constitute life. This is, in brief, the full summing up of the term *respiration.*

It is well to keep these facts constantly in mind, for, if you do, you will readily appreciate all those happenings, which, it will appear, are manifest when the oxygen is reduced, and which cause those symptoms that are generally known as oxygen want.

The percentage of oxygen in the atmosphere remains constant, irrespective of the height. The partial pressure, or tension, however, varies and diminishes in a somewhat progressively proportional manner with the decrease in barometric pressure. It is the oxygen tension in the air cells of the lungs which is most important in maintaining the respiratory process.

The following table shows the decrease of barometric pressure and oxygen tension with the increase in elevation:

TABLE SHOWING RELATION OF BAROMETRIC PRESSURE AND OXYGEN TENSION TO ELEVATION

Feet	*Barometer*	*Oxygen tension*
0	760	101.32
10,570	520	51.09
12,200	490	44.81
14,000	460	38.53
15,200	440	34.34
16,500	420	30.16
17,900	400	25.97
18,600	390	23.88
20,050	370	19.69
21,000	...	17.3

As the transfer of oxygen from the alveolar air to the blood depends, in part, upon the oxygen tension, it can readily be seen why oxygen want should promptly ensue on reaching high altitudes.

One other factor in this transfer of the oxygen to the blood is the activity of the alveolar epithelium, or cells lining the alveoli. This introduces the individual factor into the question and explains why some may go to these heights with less symptoms resulting than others. There is certainly just as much individual difference in the alveolar epithelium as there is in the color of hair or eyes. It is believed by many that acclimatization, or the acquired ability to withstand high altitudes, is brought about by the improved efficiency of the alveolar epithelium. It may be said, in passing, that this point of acclimatization has been studied by the British Air Board without any satisfactory results, as yet.

In altitudes above 16,000 feet, where the barometric pressure is half the sea-level pressure and the oxygen tension reduced to one-fourth or less, the blood is quickly deprived of the necessary oxygen to carry on the body processes, and allows of the accumulation of those substances which, sooner or later, bring on pronounced intoxication. This intoxication is particularly marked in the nervous system. Its effects are peculiar, and, unfortunately, this peculiarity is especially dangerous to the aviator.

Haldane, professor of physiology of Oxford University, states that extraordinary impairment of judgment is extremely characteristic and the person himself is totally unaware of it and quite confident that his mind is absolutely clear. In a position of danger a man may fail to

take the necessary measures for the safety of himself and those with him, even when he is well aware of the danger. Perception is more affected than sensation; one sees things without understanding them properly. It is hard, for instance, to make a barometric reading. Misjudgment of position of things is also pronounced.

Other effects are, as reported by aviators themselves: panting, difficulty in concentrating attention, headache and fatigue after landing, vertigo, vomiting, noises and pains in the ears. Many other symptoms of this intoxication have been noted and reported. Different individuals show marked variation in their susceptibility to low oxygen, but in very many cases these effects are more or less constant. For instance, in a series of thirty-five pilots examined by Capt. Martin Flack of the British Air Board, the following extracts are noted:

No. 1 (28 hours). Giddy above 4,000 feet.

No. 2 (10½ hours). Giddiness and blurring of vision when flying at 6,000 feet.

No. 3 (140 hours). Fainted twice in air above 8,000 feet.

No. 11 (300 hours). Since crash, fainted twice in air at 8,000 feet and 10,000 feet.

No. 13 (50 hours). Headache and compression and tending to dizziness above 3,000 feet.

No. 31 (400 hours). At first all right, then on three occasions faint at 7,000 feet.

No. 32 (14 months). Flying every day for fourteen months. At first all right to 12,000 feet. Now giddy at 5,000 feet.

No. 35. At first all right at 6,000 feet, but progressively uneasy at heights.

In the method of ground investigation followed by the English Board, the experimental altitude corresponds almost exactly in symptoms produced with those of the actual altitudes above noted.

Professor Henderson was associated with Douglas, Haldane and Schneider in the Pikes Peak expedition to study the effects of high altitudes. The results of this expedition, where low oxygen effects were studied on many individuals, demonstrate the fact that men differ widely in their susceptibility to low oxygen.

Unfortunately, prime physical fitness is not always a guarantee that the subject will be free from these symptoms of nerve instability. The Pikes Peak expedition showed that many men ordinarily classed as physically fit, men who had excelled in athletic work, were readily affected by that altitude—14,100 feet—and in a short time on the Peak exhibited such evidence of the effect of oxygen want that, in the aviator, would surely lead to disaster were he to be called upon to exercise his judgment, alertness or decision.

This fact of individnal snsceptibility points very clearly to the necessity for selection of the men who have been in training for overseas work. It would be manifestly a great risk to send a man np for scout work when it could be shown that an altitude of 16,000 feet would bring on in him conditions that would interfere, to say the least, with the full performance of all his activities.

These reasons seem to demand selection for scout and fighting work of the flying officers for the spring program. This board has planned an examination particularly designed to disclose the facts above set forth. The large number of men to be sent would make it impossible for all to be examined. Because of this, the board has recommended to the chief signal officer that selection for scout work be made by the commanding officers of flying schools of those deemed best fitted therefor by general observation. This selection should develop quite a large number of men. From these, selection should again be made by the examination methods proposed by the board.

This examination practically eliminates gnesswork. The method pursued will be arrived at after careful and painstaking scientific investigation. Every means will be taken to safegnard the efficiency of this examination by careful calculation and the application of all known methods of investigation, so that, when our aviators are finally sent to the front, it will be the belief that they represent the finest and best that our country has to offer.

A STUDY OF THE AEROBIC BACTERIA FOUND IN WOUNDS RECEIVED ON THE BATTLEFIELD OF THE SOMME

By First Lieutenant JOSEPH S. LAWRENCE, M. R. C., U. S. A.
Bacteriologist for the American Ambulance, Neuilly, France, Summer, 1916

THE purpose of this paper is to give the American surgeon and bacteriologist an idea of the types of organisms that contaminate gunshot wounds made on the western front, their relative frequency and importance and simple methods for their identification. The material was collected in the summer of 1916 from wounds inflicted on all parts of the body and received about Peronne at the time of the English and French drive. About 1,500 wounds were studied culturally, and more than 5,000 stained preparations were examined from July until November. A collection of fifty specimens taken at the first examination of wounds, containing, among other contaminants, aerobic sporebearing organisms, were brought back to America and studied carefully in the laboratory of Johns Hopkins Medical School. A brief survey will be made of the sources of contamination, the methods employed in a base hospital laboratory, the types of aerobic organisms encountered and their significance to the surgeon.

A knowledge of the sources of contamination is important. Every wound will be contaminated sooner or later, while the vast majority are infected at the time of making. Bullet wounds made at short range may remain sterile if they are not compound fractures, but a bullet wound made from a long range will be almost as badly torn as a wound made by a shell fragment. Most of the wounds, however, are made by pieces of exploded shells.

These pieces vary in size from several square inches in area to particles as small as a pin head and, while they in themselves may be sterile, yet because of their ragged nature, wherever they strike a part covered by clothing they take shreds of it into the wound. These shreds of clothing are the source of most prolific bacterial growth, while the tissue torn from its blood supply and necrosing, furnishes the best of medium. The body of a trench dweller is inhabited by a varied and extensive flora, so that unless the wound is dressed in less than six hours it will be infected from the skin. Wounds of the face are infected as early as those of the body, but because this tissue is highly vascular and these wounds are shallow and drain easily, their infection is not usually of such desperate character.

Another source of infection may be the dressing. The first-aid band-

age, if used, may be contaminated while being applied, or instead of a first-aid bandage a handkerchief or some part of the clothing may be employed to stop the hemorrhage. The earliest dressings made by the surgeons must of necessity be very crude, for there is little time to spend on technique. The water used to wash the wound may contain contaminating organisms. One evening seven patients arrived at the American Ambulance who had been wounded at different sections of the front and, while being transported to the rear, were dressed several times before they reached the base hospital. A bacteriological examination of their wounds showed them all to be contaminated with the same aerobic sporebearer. Inquiry into their histories revealed that they had all come together at Amiens, where they were last dressed. The source of this infection was never determined, but it is quite possible the spores were in the water used in washing the wounds. The time of the year, to a certain degree, determines the type of infection. In the winter the pneumococcus, micrococcus catarrhalis and diphtheroid organisms are more commonly found in the wounds than they are in summer. The location of the battlefield is a factor to be considered. In the lowlands of Flanders the tetanus bacillus and *B. welchi* are almost universal. On the mountains about Goritzia there were no cases of gas infection, but in the valleys of the same front it was quite common to some of the surgeons of the Italian army.

The procedure for making the bacteriological examination of wounds was about as follows: At the earliest dressing made after the entrance of the wounded to the hospital a sterile cotton swab, such as is used in taking throat cultures, was brushed over the part of the wound where the discharge was most abundant. These swabs, incased in sterile glass tubes, were sent to the laboratory and there kept in the refrigerator until evening. In the regular routine work but three media were used: nutrient broth, plain agar slants and glucose agar tubes for deep growths. The glucose agar was boiled for ten minutes to remove the air and then quickly cooled to 42° C. The swab was first immersed in the broth, then stroked over the agar slant and finally shaken vigorously in the melted glucose agar. This tube was immediately put into a bath of ice water so as to congeal it instantaneously.[1]

The cultures were incubated over night and examined the next morning. Films were made from the broth and the slant agar. If gas

[1] When gas gangrene was suspected the routine was changed slightly. The regular three cultures were made, as soon as the specimen was taken from the wound, and put into the thermostat at once. Gas rarely developed in less than twelve to eighteen hours, but if the swab on which the specimen was collected was replaced in the glass tube, after seeding the media, and this incased in a larger tube with a solution of pyrogallic acid and sodium hydroxide, thus producing anaerobic conditions, and then incubated for four hours, the presence of *B. welchi* could be demonstrated morphologically by brushing the swab over a clean glass slide and staining the film by the gram method. This saving of time was of the utmost importance in many instances.

developed in the glucose agar, the tube was broken below the surface of the agar and a smear made with the fluid that was found along the side or in the bottom of the tube. If there was no gas present, then the tube was broken opposite to one of the deep colonies and a film made of it. Our method of breaking the tube was to scratch it with a piece of carborundum or a file and then to touch this scratch with a piece of glass rod heated to white heat. By this method we secured films that were not contaminated by the surface growth. These films, having been stained by the gram method, were examined under the oil immersion lens. This was not an elaborate bacteriological investigation, but at the time it served to guide the surgeon who wanted to know as early as possible of the presence of the gas bacillus or streptococci. These were considered the particularly dangerous organisms that could be isolated and when their presence was accompanied by clinical symptoms, immediate surgical attention was imperative.

The microscopical findings were often hastily reported as streptococci, staphylococci or gram negative or gram positive bacilli. The great mass of organisms were micrococci, both gram negative and gram positive, and gram negative bacilli of the colon-proteus group. In more than 80 per cent of the wounds studied culturally, streptococci (cocci appearing in chains of four or more units) were found. In the deep or pocketed wounds the streptococci flourished, but in the shallow wounds, or when the deep pockets were opened wide, they were replaced by staphylococci in the course of healing. Gram negative and gram positive varieties of both streptococci and staphylococci were observed. Varying degrees of anaerobiasis were manifested in the deep cultures examined after twenty-four hours' growth.

Sometimes the streptococci grew on or near the surface of the glucose agar, at other times there was a ring of growth about two centimeters from the surface, and again the most luxuriant growth might be in the very depth of the tube. A study of the micrococci was begun in the ambulance but had to be discontinued because of the great amount of time required for routine work. The pneumococcus, *M. catarrhalis*, *M. tetragenous* and enterococcus, in addition to *M. aureus* and *M. albus*. were recognized, but we could go no further without the assistance of special media.

Morphological studies of smears made directly from the wounds convinced us that not all of the organisms contaminating the wounds were growing out on the culture media. We felt the advisability of making such study of morphology a part of our routine, and when the Carrel procedure was introduced to the wards and smears made from each wound every third day for the purpose of counting the microbes,

an opportunity was given to study morphologically the flora of all wounds. Thus the initial contamination could be studied as well as the time during the treatment when certain types of organisms would disappear, or, perhaps, new contaminats be introduced. Micrococci were always present in contaminated wounds, the initial morphological examination showed streptococci, diplococci and staphylococci in abundance. The streptococci soon disappeared, as a rule, and the staphylococci gradually grew irregular in size and fewer in number until finally they disappeared and only an occasional gram positive coccus or diplococcus persisted. When these were very few their presence was ignored by the surgeon when plastic work was considered and the wound treated as though bacteriologically sterile.

Gram negative bacilli, usually of the typhoid-colon size but occasionally some that were larger, were present in 95 per cent of the wounds. The larger forms disappeared promptly under treatment, but the smaller forms persisted for a longer or shorter period, especially if the wound was imperfectly irrigated, but would finally totally disappear. Culturally, these gram negative bacilli proved to be types which ordinarily abound in the alimentary tract.[2] The following organisms were isolated in pure culture with the frequency indicated. *B. coli* was found in more than 50 per cent of the wounds. The two types, one fermenting saccharose and the other not, were found in equal abundance. *B. vulgaris* was found in about 40 per cent of the wounds, *B. aerogenes* and *B. pseudo dysentericus*, (Müller, 1902) were isolated from about 25 per cent of the wounds.

B. cloacae, *B. rhinoscleroma*, and *B. alcaligenes* were each isolated from 10 per cent to 20 per cent of the wounds.

B. pyocyaneus was isolated from only about 10 per cent of the wounds while they were still fresh, but as the wounds grew older it was found more frequently.

Larger bacilli, both gram negative and gram positive, were observed in about 20 per cent of the wounds and, when cultured, proved frequently to be aerobic spore bearing organisms. Of these the following varieties were isolated. Arranged in the order of their frequency, they are: *B. cereus*, *B. mesentericus*, *B. vulgatus*, *B. subtilis*, *B. fusiformus*, *B. albolactus*, *B. aterrimus*, *B. megatherium*, *B. brevis*, *B. terminalis* and *B. circulans*. These organisms usually disappeared very promptly from wounds under treatment.

Other gram positive bacilli, but non-sporebearing, were very like B. *diphtherae* in morphology. These organisms were more prevalent in the winter than in the summer.

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[2] Ford, W. W. Studies from the Royal Victoria Hospital, Montreal, 1903. Classification and distribution of the Intestinal Bacteria found in Man.

The significance of the presence of these aerobes is becoming more apparent as the study and care of wounds progress. Their presence in the first place indicates contimanation and the impracticability of closing the wound. The presence of a few *M. albus* in the exudate is not necessarily a contraindication to closing the wound, but they must not be more plentiful in the testing films than an average of one for each two oil immersion fields. The persistence of aerobes in the exudate indicates an unirrigated discharging sinus or a hidden foreign body. The type of aerobe changes as the wound ages. At first there are *M. aureus* and *M. albus* and streptococci with *B. coli* or *B. vulgaris*, but as the wound improves the streptococci are eliminated, first from the surface and lastly from the depths, especially when the bone is involved. Finally, *B. pyocyaneus* appears while the other bacilli are banished.

The presence and persistence of the aerobic sporebearing organisms are interesting. They share, with the other aerobic contaminants, the human intestine as habitat, and so perhaps are normally present on the skin and clothing of a trench dweller. They do not appear to be wholly benign when found in combination with strepotococci or some anaerobes. Wounds contaminated with *B. fusiformis* or *B. brevis* do very badly when deep, where anaerobes can act conjointly with the aerobic sporebearers. They sometimes sporulate while in the wounds and morphologically may resemble certain anaerobic spore-forming organisms. On one occasion a very severe compound fracture of the arm was observed to do exceptionally well as long as the contamination was confined to *B. cereeus* and *M. albus*.

The presence of these aerobic organisms may have no significance whatever in a shallow flesh wound, while in a deep wound or a compound fracture they may aid greatly in producing proper conditions for the development of anaerobes. They attack albumen slowly, but will destroy it completely, and while they do not produce toxic conditions as rapidly as many of the anaerobes, yet they do produce a definite intoxication. Some of the spore-forming organisms, as *B. vulgatus*, produce hemolysins. These observations indicate that

(*a*) The type of contamination may vary with the location of the battlefield, with the time of the year, with the age of the wound and with the care exercised in making the dressings.

(*b*) The contaminating organisms are saprophytes or parasites from the air or intestinal tract.

(*c*) They are mostly non-pathogenic, but, when exceptionally situated, may produce toxic conditions.

THE RELATION BETWEEN THE AMPUTATION AND THE FITTING OF THE ARTIFICIAL LIMB

Office of the Surgeon General, U. S. Army
The Division of Military Orthopaedic Surgery

(Three illustrations)

THE AMPUTATION

LITTLE attention has been given by surgeons to the fitting of artificial limbs. As a rule the surgeon rarely sees his patient after the healing of the wound, but turns him over, usually without supervision, to the care of the artificial limb maker. Hence the surgeon loses one of the most valuable means of control in the perfection of his technic and frequently errs in comparatively simple details which a knowledge of the fundamental points of the artificial limb maker's art would enable him to avoid. It seems wise, therefore, to call attention to those points in the technic of amputations which have a direct bearing on the fitting and wearing of a substitute.

In war, as is well known, amputations must usually be performed under conditions which exceed the most adverse in civil life. During an active engagement decisions must be quickly made: the wounded are suffering from shock and often from exhaustion, and the chances of infection are multiplied to the highest degree.

The questions of when to amputate, at what point it should be done, what type of amputation should be chosen and whether the incision can with safety be closed are obviously matters of the most vital importance to the individual and also determine whether his after-care and the fitting of the artificial limb are to be easy or difficult. It is admitted that in the first months of the war, when conditions were particularly unfavorable and infection ran rampant, amputations were sometimes performed carelessly and stumps left open that could with safety have been closed.

The question of amputation is, therefore, one of the most serious problems the army surgeon must face and one that calls particularly for calmness under stress and for the exercise of the most sound surgical judgment. When the requirements necessary to conserve the safety of the patient have been met, the sole remaining consideration is to be given to securing the stump which will best meet the demands made upon it by the artificial limb.

END-BEARING STUMPS

The importance of securing an end-bearing stump in the lower extremity is not sufficiently recognized. The usefulness of a success-

ful Syme, Pirogoff or Gritti-Stokes has long been known. Yet with these exceptions artificial legs are designed by the makers to take the weight on the ischial tuberosity when the amputation is above the knee, and laterally on the tuberosities of the tibia when it is below, and little or no attempt at end-bearing is made. The possibility of securing an end-bearing stump in a large proportion of cases has, however, been clearly demonstrated,[1] and it is highly desirable that the surgeon and the artificial limb-maker should coöperate to achieve it; for it is obvious that the transference of even a part of the weight to the end of the stump will conduce to greater comfort and improved function.

The chief responsibility rests, however, upon the surgeon, since the prerequisites for end-bearing are a good stump and early functional use. "The best formed stump, if not quickly put to use as a real support, may become atrophied and useless" (Lyle).

The experience at Roehampton as to the proportion of cases capable of some end-bearing is shown in the following table, given by Little:

Cases Fitted with End-bearing Pad

Upper third of thigh	2 out of 22 =	9 per cent
Middle third of thigh	75 out of 235 =	32 per cent
Lower third of thigh	63 out of 81 =	77 per cent
Through the knee-joint	5 out of 6 =	83 per cent
Upper third of leg	42 out of 74 =	56 per cent
Middle third of leg	64 out of 98 =	65 per cent
Lower third of leg	6 out of 14 =	43 per cent
Syme's amputation	12 out of 14 =	86 per cent

Three Stokes-Gritti and two Pirogoff's amputations were all capable of bearing weight on the end of the stump.

RELATION TO TECHNIC OF AMPUTATION

It is apparent that the choice of procedure in the various steps of amputation will depend on (1) the presence or probability of infection, (2) the general condition of the patient and (3) the local circumstances under which the operation is to be performed.

When all conditions are favorable, that technic may be chosen in each step which experience has shown is likely to give the most useful stump. This is one in which—(1) the scar is so placed as not to be exposed to pressure, (2) the soft parts are sufficiently voluminous to be freely movable over the end of the bone but not redundant, (3) the divided muscles and fascia are united over the bone end, (4) the nerve ends are not hypersensitive, and (5) the end of the bone is smooth and rounded.

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[1] Lyle, H. H. M.: *Jour. A. M. A.*, Vol. xviii, 1914, p. 1149.
Little, E. M., *Brit. Med. Jour.*, October 27, 1917, p. 550.

In *the presence or probability of infection*, long flaps are contraindicated because of the lowered resistance following the impairment of circulation incident to their formation. Hence it is recommended by the Inter-allied Surgical Conference[2] that "amputation for infection should be flapless or with short flaps held apart." Furthermore, it is obvious that the periosteum and bone should be treated in the simplest manner possible—by transverse division in the same plane.

Flapless (so-called Guillotine) Amputation.[3]—This method has obtained considerable favor as it seems to possess sufficient advantages in severely infected cases to recommend it over the usual flap operations:

1. It lessens shock by (*a*) shortening the time of operation and (*b*) permitting amputation at the lowest possible level.

2. It decreases the danger from infection by (*a*) exposing the least possible extent of raw surface and (*b*) avoiding the impairment of the circulation incident to the formation of flaps.

3. It is also said to lessen the risk of secondary hemorrhage.

Its indications are stated to be gaseous gangrene and certain cases of compound comminuted fracture and of multiple wounds.

"The skin and deep fascia are divided, usually in circular fashion, but sometimes more skin may be gained by making the incision oblique; after retraction has occurred, the muscles are divided at the level of the retracted skin—not too quickly so as to allow a retraction of the layers; then the bone is sawn flush with the muscle; vessels are secured and nerves carefully shortened."

If the operation has been properly performed, the surface is at first slightly concave, but soon becomes convex from further retraction. This must be overcome by extension. (For method see "Stump Extension.")

Re-amputation is, of course, necessary. This may consist only of the removal with the Gigli saw of the necessary length of bone, or one of the typical flap operations may be performed. (It has been stated by others, however, that it is often possible to perform a secondary suture after four or five days.)

A poor general condition of the patient also demands that simplification of technic which will ensure the least shock; this does not, however, contraindicate the use of flaps, although in regulating their size the possible effect of the lowered general resistance on infection should be borne in mind.

Unfavorable local circumstances, as poor facilities or stress under the "peak load," also render advisable a similar simplification of technic.

With these restrictions, the following points of technic are emphasized as of particular importance in the formation of a suitable stump:

Placement of Scar.—In the leg "amputation by circular incision results in terminal cicatrices which have every defect of situation, shape

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[2] *The Medical Bulletin:* Pub. by Am. Red Cross Soc. in France. Vol. i, November, 1917, No. 1, p. 11.
[3] Kelly, M. Fitzmaurice: *Brit. Jour. Surg.*, April 16, 1916, p. 676.

and adherence; on this point all surgeons are agreed."[4] When flaps are not contraindicated, therefore, they should be made of unequal length so that the resulting scar will fall where the terminal and lateral surfaces meet.

In the arm pressure is exerted laterally and not on the end of the stump, hence here the scar, with the exception to be noted, should be terminal. Amputation by the circular method or by short, equal antero-posterior flaps is therefore preferable, except in the case of the wrist, where a palmar flap gives an excellent stump.

When the incision is left open, whether the circular method be used or the one with short flaps, extension must very soon be applied to the skin to overcome retraction and thus limit the size of the resulting scar. (For method see "Stump Extension.")

Attention to Soft Parts.—The comfort with which the appliance is worn and the freedom with which it is used are influenced to no small degree by the condition of the terminal soft parts. Adherence of the skin to the bone is most undesirable and is a frequent cause of reamputation.

For this reason it is desirable, whenever possible, to suture the muscles and the deep fascia. Silk should not be used. The tissues should be of sufficient bulk to move freely over the end of the bone. Redundancy should, however, be avoided as in this case the skin is apt to become excoriated from rubbing against the walls of the socket.

Treatment of the Nerve Ends.—Pain in the stump is one of the most common annoyances of the amputated and in a large percentage of cases is due to trouble with the ends of the nerves. In every amputation, therefore, the greatest pains should be taken in the division of the nerves. The nerve should be drawn down strongly, out of its sheath, and an inch or more removed. Various additions to the technic have been suggested to still further protect against overgrowth of the end: a modification of the fish-tail method of Ritter (Fig. 1) is recommended as meeting the indications most simply and effectively.

Treatment of the Bone.—To meet the requirements of the artificial limb, especially if end-bearing is sought, the bone must be smooth and rounded. Recent studies in the processes of osteogenesis indicate how this may be secured. Viewed in the light of what these studies have taught, it is obvious that the common method (periosteal) of treating the bone is objectionable. In this method the periosteum is first peeled back and then drawn down again over the sawn end of the bone. This necessarily results in more or less shredding of the periosteum and consequent bony overgrowth, the very condition it is desired to avoid. When

[4] Tuffier: *Brit. Jour. Surg.*, Vol. iv, 1916, p. 422.

the indications call for the simplest effective technic, the periosteum and the bone should be divided in the same plane, and care taken to remove any periosteal shreds present. Clinical results seem to indicate, however, that the aperiosteal method (Bunge) is more likely to give an end-bearing stump, even in the presence of infection.

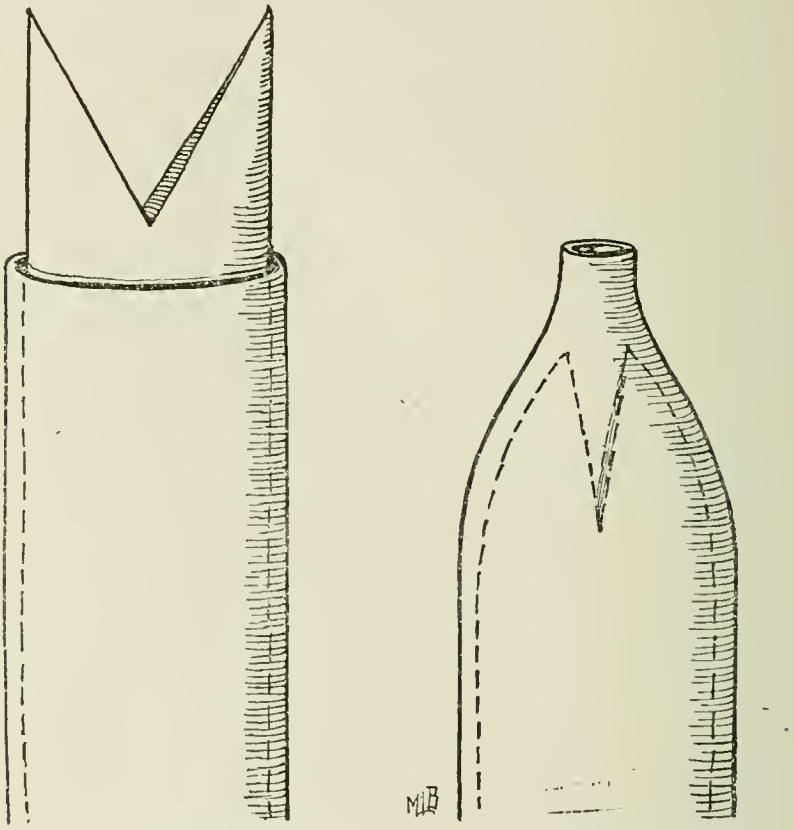

FIG. 1.—The fish-tail method of treating the nerve end, showing the manner in which it is divided and how the points fall together and are covered by the sheath after retraction.

In this method 1 cm. of the periosteum is removed from the end of the bone and the marrow curretted out for the same distance. Care must be taken not to remove too much of either the periosteum or the marrow in order to avoid the danger of a localized osteomyelitis in the end of the shaft. The osteoplastic method seems to offer an ideal technic but it is obviously unsuited to any other than ideal conditions.

RELATION TO THE SITE OF AMPUTATION

While as a general rule amputation should be performed at the lowest possible level, yet this is not always the case. In some instances

a higher point is made desirable by anatomical conditions or by the requirements of the artificial limb. As an example of the former may be cited amputation through the tarsus in which sooner or later a position of equinus is likely to result and walking becomes difficult or impossible. The best example of the latter is disarticulation (except at the shoulder, hip and wrist). Although the retention of the bony enlargement of the proximal portion of the joints is of decided advantage in retaining the artificial limb in position, yet the best type of appliance requires several inches for the joint mechanism, so that if this were used in the case of disarticulation, it would result in making that segment of the limb longer. It is true that the ordinary type of joint may be used, but as this is placed on the sides of the stump, it gives a very bulky appearance and the construction is weaker. It is usually regarded as preferable, therefore, to amputate at a sufficient distance above the joint to allow the necessary room for the artificial limb mechanism.

In this connection, however, attention is again called to the fact that in the flapless, or so-called guillotine, operation no consideration is given to these points just mentioned, the bone always being divided at the lowest possible point and reamputation performed later under more favorable conditions.

Upper Extremity.—In the *hand* it is generally recognized that "the importance of preserving as much as possible of the thumb and fingers need hardly be emphasized. A thumb, or part of a thumb, together with some portion of fingers or hand to which it can be opposed, is more useful than any artificial contrivance which can be fitted. In this region irregular operations—trimming, removal of splinters of bone or sequestra, etc., are likely to give better functional results than any set amputation."[5]

At the *wrist* there is a decided advantage in disarticulation on account of the better preservation of the forces of pro- and supination, which are now being used to activate the artificial hand. Moreover, in this case it is easy to put the necessary mechanism below the wrist. A further advantage in amputation at this point is that the enlargement of the wrist is a decided aid in holding the artificial arm in position.

In the *forearm*, amputation in the lower part of the middle third gives a good and useful stump. While the circulation of stumps in the lower third is often poor, yet the better preservation of the power of pro- and supination that is secured by amputating as near the wrist as possible makes this site desirable; to ensure freedom of these movements every precaution should be taken at the time of operation to guard against

[5] Official Memorandum on Amputation. London, March, 1916.

union of the ends of the bones by osseus or fibrous adhesions. Above the middle of the forearm it becomes of increasing importance, the nearer the elbow is approached, to save every fraction of an inch possible. When the stump is less than three inches, great difficulty is experienced in preventing it from slipping out of the socket, owing particularly to the action of the biceps tendon during flexion of the elbow, and with the short stump there is also naturally a decided loss in leverage. "If it is impossible to get a forearm stump extending at least an inch and a half below the insertion of the tendon of the biceps, amputation above the condyles of the humerus is to be preferred."[6]

In the *upper arm* the lowest point at which amputation is desirable is just above the condyles (about 2 inches above the center of the joint); the reasons for this are similar to those already discussed. From this point the longer the stump the better. Above the middle of the upper arm the surgeon must utilize every surgical expedient to save all the length possible; the power to control an artificial arm diminishes to an alarming degree with each loss of even a slight portion of bone. But little can be expected from a stump in which the bone extends less than 2 inches below the axillary fold. Since a terminal and even an adherent scar is not particularly objectionable in the upper extremity, owing to the pressure being exerted laterally, skin-grafting (usually inadvisable in a leg stump) may be employed to cover defects rather than a re-amputation performed. Moreover, in some cases, "a good deal can be gained by removing wholly or in part the folds of the axilla, that is, the pectoralis major and the teres minor. This has been done with good results and seems to be an operation worth doing in suitable cases."[7] It is always advisable to retain any portion of the upper end of the humerus, even if only the head, rather than to remove it (as is necessary under similar conditions in the thigh), since the appliance is fitted much more easily when the glenoid cavity is filled.

Lower Extremity.—In the *foot* it is undesirable to save a solitary toe, even the great toe. Amputation just back of the heads of the metatarsal bones, in front of the attachment of the tibiales and peronei, may be fitted so as to give a useful foot; but amputation through the tarsus, back of the muscular attachment just mentioned, is usually unsatisfactory, as sooner or later a condition of equinus is likely to result due to contraction of the unopposed calf muscles and walking becomes difficult or impossible.

At the *ankle* a satisfactory end-bearing stump is usually secured by Syme's amputation, in which the bones are divided just above the joint

[6] Little, E. M.: *Brit. Med. Jour.*, Oct. 28, 1917, p. 550.
[7] *Ibid.*

line and at right angles to the long axis of the tibia. The Syme is preferable to the Pirogoff, as it gives more room for an ankle joint mechanism and avoids the difficulty frequently encountered in keeping the end of the os calcis in position.

In the *lower leg* the middle third is generally considered the most favorable site; many artificial limb makers[8] prefer amputation at the middle of the leg to any amputation back of the toes. With proper surgical precautions and a good modern artificial limb, end-bearing usually should be secured and the gait be practically normal. The fibula should always be cut an inch shorter than the tibia and the sharp point of the tibial crest removed in the usual manner. The lower third is not so favorable; the tibia is smaller at this point and so not so satisfactory for end-bearing, and circulatory disturbances are not infrequent. In the upper third a very short stump of course gives poor leverage but fair results are sometimes obtained with as little as 2 inches of bone. However, a stump as short as this is usually inadvisable, as it will ordinarily have to be fitted with the older type of knee-bearing leg—with the tibial stump bent to a right angle; this has only the advantage of direct weight-bearing, which can usually be secured by amputation at the lower end of the femur, and possesses all the disadvantages incident to artificial knee-joint construction.

Emphasis needs to be laid on the fact that the old "site of election" (4 inches below the knee) was intended to produce this direct weight-bearing stump and must now, therefore, be entirely disregarded.

In the *thigh* the best amputation is, of course, one just above the condyles; when conditions permit, the patella may with advantage be utilized to cover the end of the femur. (The preservation of a part of the condyles, with the patella imbedded in them, is favored by some limb makers, as it enables the weight of the apparatus to be borne by the leg itself). Above this point all the length possible should be saved, as the possibility of end-bearing decreases rapidly as the upper limit of usefulness as regards leverage is approached. (See table, from Little.) A stump in which the bone is less than 3 inches, measured from the pubis, is of little value, and exarticulation is preferable. The linea aspera requires attention in the same manner as the crest of the tibia.

To avoid shock a sub- or intra-trochanteric amputation may be first performed by the flapless or short flap method, and the removal of the end of the bone left for a later period.

It is now possible to fit an exarticulation of the hip with a very satisfactory appliance; in some cases the gait is even better than with the shorter stumps.

[8] Questionnaire. Association of Artificial Limb Manufacturers of the U. S.

STUMP EXTENSION

When the incision is left open, whether the circular method has been used or the one with short flaps, traction should be applied to the skin, as soon as the acute inflammation has subsided, to overcome retraction and thus limit the size of the resulting scar. If it has been possible to make flaps of sufficient size, the skin may be pulled down sufficiently to approximate the edges and in some cases a secondary suture may be performed; if the tissues are not sufficient to cover the bone, they are kept from retraction until it is safe to perform a secondary removal of the projecting bone or a typical reamputation.

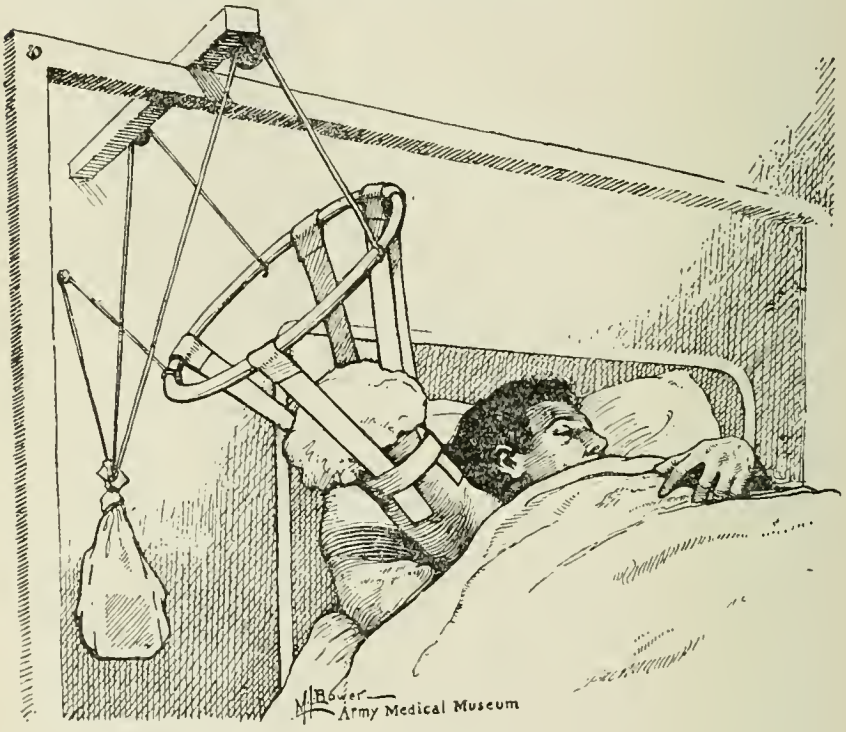

FIG. 2.—"The extension apparatus applied to a stump after amputation through the upper third of the arm." (From Bryan.)

The two methods of extension illustrated (Figs. 2 and 3) seem to meet all indications. In both, adhesive strips are applied to the stump in the axis of the limb as far as the joint above and held in place by a circular strip, or pieces of gauze are applied in a similar manner with the adhesive glue; the ends are fastened to a ring, which may be attached to a weight extension or to the end of a modified Thomas knee splint.[9] The stump

[9] Sinclair, M.: Collection of Fracture Apparatus Used in the British Army. International Conference, May, 1917.

is thus left accessible for dressing. According to Bryan[10] "the method of extension by weight and pulley gives more powerful and continuous traction than a fixed extension; it allows more movement in the joint above; it adjusts itself to the patient's movements in bed and he is more comfortable and more easily nursed."

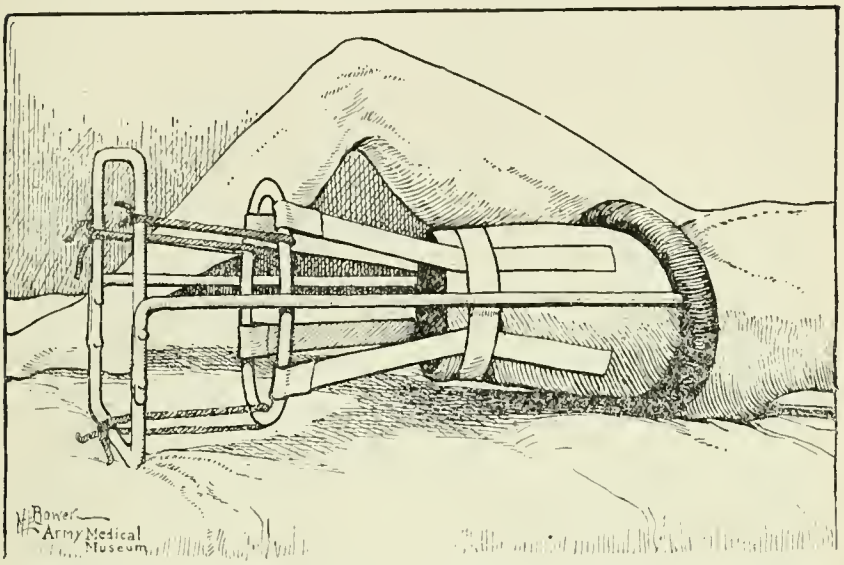

FIG. 3.—Stump extension with a modified Thomas knee splint. (Adapted from Sinclair.) "A Thomas knee splint is cut down and a 9-inch square rivetted on to the side bars 12 inches beyond the end of stump. An 8 inch circle of aluminum is attached by gauze and glue to the skin of the stump so as to be 6 inches distal to the cut surface. Extension is made from the ring to the square either by tapes or rubber bands. The square acts as a pedestal and also for the attachment of the extensions."

THE CARE OF THE STUMP

Proper care of the stump is indicated broadly for two reasons: (1) to secure ultimately the maximum degree of usefulness, and (2) to minimize the difficulties associated with the first attempts at using an artificial limb and thus avoid discouragement of the maimed.

Freedom from sensitiveness to pressure is the chief qualification of a good stump and is the measure of its capability for end-bearing. This is mainly dependent on the absence of swelling and congestion in the soft parts and above all of exostoses on the bearing surface of the bone. (See also "Painful Stumps.") It is evident, therefore, that those measures must be used which will hasten absorption and prevent the formation of exostoses or limit their location to less harmful areas. In addition to the measures usually employed for such purposes, namely, elevation of the part, bandaging, massage, hydrotherapy, electric light

[10] Bryan, C. W. G.: *Jour. R. A. M. C.*, May, 1916.

baths and electricity, particular emphasis must be laid on the benefit derived from early functional use; carefully graduated pressure on the end of the bone helps to give it a smooth and rounded shape and limit the formation of exostoses to the less harmful location at the sides. Hence early functional use is the second prerequisite for end-bearing; the most careful surgical technic may be of no avail if the proper care of the stump is not begun at the earliest possible moment. This undoubtedly is the explanation for the fact that artificial limb makers are as a rule not enthusiastic about the possibilities of end-bearing; the cases reach them too late for anything further to be gained in this direction, so that unless the surgeon has prepared the stump for end-bearing by the early institution and the persistent use of the necessary measures, end-bearing will be possible only in exceptional cases.

Muscular weakness and limitation of motion are two of the chief causes of discouragement in learning the use of an artificial limb. Considerable strength is obviously required to manipulate it satisfactorily. The demand is naturally greater with the shorter stumps and is still further increased if joint stiffness is present. When a contracture has been allowed to develop, this may make the use of an artificial limb difficult or impossible, as, for example, in amputation of the thigh the stump tends to become slightly flexed and abducted, and this may easily become sufficient to prevent the use of an artificial leg until it has been overcome. The preservation of the full range of motion of the joints above the site of amputation is therefore of particular importance. The incentive to movement of the part is absent and hence limitation of motion develops more rapidly and is usually difficult to overcome, particularly in the case of a short stump, owing to the poor leverage afforded. Contractures must, therefore, be guarded against from the first and movements of the joints must be begun just as soon as the condition of the incision permits and persisted in until the full range of mobility in all directions is assured.

ROUTINE FOR PROPER STUMP TREATMENT

To meet all indications the plan of treatment must be systematic. *While the incision is healing,* at each dressing the stump should be moved to the full limit in the opposite direction to that in which a contracture is likely to develop. In forearm stumps, movement should be carried out in supination and extension; in upper arm amputations, in upward and backward motion; in the lower leg, in extension and in thigh amputations, in extension (securing hyperextension) and adduction. It is usually advisable to keep all stumps elevated while the patient is recumbent and therefore particular attention should be directed to thigh amputations because this position favors a flexion contracture; to coun-

teract this tendency it is recommended that once or twice each day the pillow be removed from under the stump and placed under the buttock, thus allowing the stump to drop into hyperextension. Further, advantage should be taken of the position in which the stump is dressed in order to guard against the tendency to contracture; thus in forearm stumps, where supination is hardest to control, the dressing should be applied so as to maintain the bones in this position. When the incision has had to be left open, movement of the joint in the other directions, also, should be added as soon as conditions permit.

As soon as the wound is healed, or practically so, and while the patient is still confined to bed, the following routine (modified from Hirsch) is begun:

1. *Massage.*—The stump should be massaged for a period varying from ten to thirty minutes, once or twice a day, according to its size and position. The region of the incision should naturally be avoided for the first few times and care taken not to make undue tension on the fresh scar. As rapidly as the tolerance of the stump will permit, the depth and the force of the massage should be increased up to the full normal limits.

2. *Bandaging.*—After the massage, the stump should be redressed with a cotton dressing, bandaged snugly in place, or if it is well healed, a bias flannel bandage alone may be used. The latter, when properly applied in several layers, gives a firm, even pressure.

3. *Pressure Exercise.*—The patient is directed to press the end of the bandaged stump against a cushion, placed in the bed or against a frame. This must be begun with care, pressure being made at first for only several minutes at four or five hour intervals; if there is no unfavorable reaction, it should be increased gradually up to five or ten minutes every two hours and then every hour.

4. *Movements.*—After each pressure exercise, active movements of the stump are to be made in all directions, to the full limits of the joint motion, for three to five minutes. Later, some form of resistance movements may be added to advantage, in order to still further build up the strength of the muscles controlling the stump and so make the early use of the artificial limb more easy.

5. *Baths, etc.*—Hydrotherapy in the form of hot packs or warm baths, or electric light baths are to be used as indicated to improve the circulation and hasten absorption. The contrast bath is particularly valuable, the rapid dilatation and contraction of the blood-vessels which it produces causing a marked improvement in the local vascular and nervous tone; the simplest method of application consists in the use of two buckets, the stump being plunged first into the hot water and then

into cold, as rapidly as the patient can change it, for five or ten minutes.

When the patient is able to leave the bed, the measures just outlined are to be continued, but in the case of leg amputations the pressure exercise is to be discontinued as described and direct weight-bearing on the stump begun. A stool of the proper height and a cushion are provided and the patient, supporting himself with his hands, allows at first only a little weight to rest upon the bandaged stump; the amount of weight borne and the time are then gradually increased, in a manner similar to that used in the pressure exercise in bed, until the entire weight can be taken on the stump. The patient may then carefully begin to hammer on the stool with the end of the stump, in imitation of the pounding which takes place in walking with an artificial limb provided for end-bearing. As soon as the patient can stand alone for a long time without getting tired, and with no other support than that needed to balance himself, a temporary leg, properly provided for end-bearing, may be fitted and walking begun, crutches being used guardedly and dispensed with as soon as possible. For a long time, however, the patient should continue to practice standing on the bare stump on a hard surface three times a day.

The value of end-bearing is generally admitted. The measures suggested, both with respect to the amputation and the care of the stump, are simple and have borne the test of clinical experience. Their persistent use is urged upon all. While it is recognized that in very many cases the presence of long continued infection will seriously delay the institution of proper after-treatment, yet much good may still be expected even when begun late, and there will be a large number in which the routine may be followed from the first. The ideal cases will obviously be those requiring reamputation, which will naturally be deferred until entirely favorable conditions can be secured and which can, therefore, be performed solely with regard to the requirements of the artificial limb. Even when the attempt to secure end-bearing is unsuccessful rigid adherence to the routine just described is still to be insisted on; the improved conditions of the stump, the greater freedom from pain and the avoidance of much of the discomfort usually associated with the early use of an artificial limb are more than sufficient to repay one for the additional trouble.

SYSTEMATIC EXAMINATION OF RANGE OF MOTION

The joint motion should be tested by the surgeon at regular intervals, particularly in bed-ridden infected cases, in order to be certain that the full range is retained. At the elbow, in addition to verifying the presence of complete flexion and extension, the freedom of rotation of the

radial head must be determined and particularly with reference to outward rotation (supination); the value of the movements of pro- and supination in activating the artificial hand will depend upon the degree possible, the loss of even a few degrees making a great difference. Of the movements of the shoulder girdle (upward, downward, forward, backward, and circumduction), the upward and backward ones are the most important; these may be easily tested with the patient lying at the edge of the bed or turned on the opposite side. At the knee it is well to remember that there are normally a few degrees of recurvation. In testing the hip, the presence or absence of flexion deformity may be determined (following the method used in hip disease) by flexing the opposite thigh fully on the trunk, the stump rising from the bed when a contracture exists, or with the patient lying on the face, the degree of hyperextension may be determined (again as in the similar test used in hip disease) by lifting the stump with one hand while holding down the buttock with the other; in testing the amount of adduction, movement of the pelvis should be controlled with one hand while the other manipulates the stump.

AFFECTIONS OF THE STUMP

Sinuses.—Persistent sinuses are an occasional source of annoyance. They are a hindrance to the proper use of the measures necessary for the care of the stump and delay the fitting of the artificial limb. Necrosis of bone is naturally by far the most common cause; as is well known, sinuses due to this cause may close temporarily and even remain closed for several weeks. In addition to other diagnostic methods, radiographic examination is most helpful; should a sequestrum be disclosed, its removal is, of course, called for. In old sinuses the possibility of specific disease will naturally always be considered. Occasionally sinuses are due to foreign bodies, as for example, to retained silk, a suture and ligature material which should not be used in this work.

Ulceration.—Ulceration of the skin of the stump is sometimes troublesome. The common cause, in the stump itself, is poor circulation (most often seen at the lower third of both arm and leg) and this is favored by general debility, constitutional disease and intemperance; when there is too great tension on the scar, due to too short flaps, it is likely to break down and an ulcer form. Ulceration is more common, however, after the use of the artificial limb has been begun and is then usually caused by a poorly fitting socket which allows friction or causes unequal pressure; in some cases also it results from the circulation to the end of the stump being cut off by a socket which is too tight around the top.

Painful Stump.—Painful or sensitive stumps constitute one of the chief sources of difficulty in the satisfactory adjustment and use of the

artificial limb. The cause may be in the soft tissues, the nerves or the bone. In the soft tissues, atrophy may be so extreme as to leave the bone insufficiently protected or the pain may be caused by an adherent scar with defective nutrition. Both these causes are avoided by the use of the proper after-treatment. In the nerves, pressure from scar formation or over-growth of the nerve end are not now so common as formerly, since greater care is usually given to this part of the technic of amputation. Cases which do not yield to ordinary measures will require operation, the compressed nerve being dissected free or the bulbous end treated by the method already recommended. By far the most common causes of pain are found in the bone itself; these are exostoses, osteitis or periostitis and small areas of osteomyelitis. To determine the exact source of the trouble is often difficult and may tax all the ingenuity and patience of the examiner; an X-ray examination of the bone should always be made in such cases and the possibility of specific disease carefully considered.

MEDICO-MILITARY NOTES

By Major R. W. HINDS

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(Concluded)

In Belgium the most striking thing in wounds was the appearance of the muscular tissue in the path of the bullet. This path was fully two-thirds of an inch in diameter. The tissues were pulpified as if ground in a mortar—total loss of structure, a grayish red, but enough connective tissue bands left so that it was quite tenacious; an oozing mass.

If clean, spontaneous recovery occurs, so that wounds of entrance and exit are barely visible. Many cases of this kind are seen in hospitals at the rear, with a consequent misunderstanding of the damage done by the high-power bullet. The pulpification of tissue accounts, to my mind, for the ease of infection, secondary hemmorhage or aneurism, and severe neuritis cases. Foreign substances carried into the wound by rifle bullets, I will discuss later. Shrapnel balls, on account of their size, are apt to carry in pieces of clothing, and shell fragments still more so. Large pieces of shell carry ahead and cut out pieces of clothing which exactly fit the face of the fragment that presented on entrance to the body. The amount of foreign substance found in the path of the projectile, or perhaps just in front of it, if lodged, is astonishing.

The indications for operation on wounds of soft parts are simple; cut away the skin edges and fascia at the wounds of entrance and exit and look at the muscular tissue. Macroscopic dirt means that the wound should be opened wide, and the tissue, with the dirt it bears removed. This is the only way to get the dirt out.

The methods of La Panne were undoubtedly influenced by the fact that gas gangrene was most prevalent in that area. But one look at the amount of foreign substance found in wounds would convince anyone that the most radical sacrifice of tissue is necessary. If pulpified tissue is left, it rots out with secondary hemorrhage. The futility of first-aid packages in these cases is most evident.

At base hospitals the location of foreign bodies, metal and bone, is difficult. The X-ray, two views at right angles to each other, helps a lot. A really satisfactory method of localization I have yet to see. The fluoroscope is still better if used during the operation. In hospitals near the front an X-ray is necessary to show if a retained foreign body exists, not by any means easy to determine, and in a general way its location. In fresh wounds the path of the projectile is easy to find.

Frequently a rifle bullet wound, for some reason with little or no pulpified tissue and clean, will be hard to follow, and these are the cases that are better left with a simple opening of the wounds of entrance and exit, or, if no exit and no evidence exists of dirt having been carried in, left alone. Undeformed bullets in wounds are the exception, core and lead fragments being the rule. As an example of the unexpected and also of the necessity for an X-ray I will cite the following case. A wound of entrance and exit were not directly connected. The projectile had glanced off the femur, leaving an angular path, but a fragment had taken another angle. It went to the other side of the femur and lodged. It would have been entirely missed without an X-ray. So one entrance and two exit wounds are a possible combination. Two wounds on opposite sides of an extremity are not necessarily entrance and exit; they may both be entrance wounds. Men with multiple shell wounds may have wounds on opposite sides of the body, due perhaps to ricochet.

Shell wounds of the lower back, buttock, and thigh are of most frequent occurrence for the reason that when there is an explosion a man naturally crouches forward, and the exposed part is hit. Layers of clothing carried into a wound have, when found, the appearance and feel of felt wadding. I found in one case the shoulder seam, with turned-in edges of an overcoat, part of its lining, a piece of the under coat and its lining. Grenade wounds are usually multiple, forty odd in one case. If the explosion is close by, there may be almost complete destruction of a member, or loss of life.

I saw a number of cases where a bullet had passed between the tibia and fibula and the developments of these cases were so similar that they are worth describing. Upon paring the skin edges and trimming away the fascia, the muscle was seen to be dirty and pulpified to a marked extent, so this also was removed, the whole channel being in the same condition. A centrally located blood clot was removed. An obstinate oozing made necessary the ligation *en masse* of tissue which included the anterior tibial, or the ligation of the artery itself, followed by a similar ligation of the posterior tibial. In these cases the operator often feels that he has injured the vessel with his scissors, but after he has found the same condition repeatedly, he begins to believe that the impact of the bullet, the vacuum in its path, or whatever the cause of the pulpification, must have injured the vessels, which later stopped bleeding through a combination of clotting and pressure of the surrounding clot. The foot of the patient is then pulseless and looks bloodless. In a large majority of cases the day following shows a foot of good color and warm. Some come to amputation shortly, usually as a result of gas gangrene rather than failure of the circulation of the extremity.

At Haslar I saw a few cases of blindness, a result of explosions, fundi negative, sometimes with subconjunctival hemorrhage. The cause at that time was variously attributed to hemorrhage from the artery, injury to the nerve near the entrance to the orbit, or to concussion. These were all cases from warships.

At Haslar they paint the plaster casts with a 3 per cent methyl alcohol solution of iodine, as the result of which they do not become foul, due to the antiseptic action of the iodine. Dr. Wildey, staff surgeon, also uses iodine, same strength, in atomizers with a double bulb to insure a steady flow and rubber instead of metal connections. Although irritant to the eyes the highest efficiency is claimed for it, as well as an even distribution to the skin, with less risk of burns, and a saving of five-sixths of the expense, as five-sixths of the iodine is usually thrown away with the swab. Clean operative wounds are sprayed every day, and it is claimed that stitch abscesses have never developed.

The preparation of the skin before operation is worthy of mention. Following the usual shaving and cleansing of the skin at time of operation, the skin is wetted with alcohol and scraped repeatedly with a straight edge, to remove loose corneal fragments, also to express secretion from the mouths of the glands. The amount of material gathered on the edge of the scraper is astonishing. Then the iodine spray is applied.

Padded splints are covered with a waterproof material like oiled silk and, if soiled by discharges, are kept odorless by an iodine spray. Should the splint be posterior and it is not desired to move the limb, a strip of gauze wet with iodine is passed between the splint and the extremity and pulled back and forth until the splint is coated.

Bullet wounds of the abdomen at La Panne were all operated upon and, in a great majority of the cases, the localized injury to the small gut was so great that it was impossible to suture it and leave a patulous gut, so a resection and anastomosis, or sometimes several, were the rule. The mortality was very high, due in all probability to late operation, on account of a long journey in an ambulance. A part of the routine was to use ether in cleansing the peritoneal surfaces.

Empyema was common, most of it following infected haemothorax cases, the rest coming from extensive wounds of the chest wall. The treatment was resection of a piece of rib about 4½ inches long, the skin and the pleura being sutured together. Pus pockets form in the region of the collapsed lung and have to be evacuated. A case in England illustrates the resistance of some of the soldiers. This man was shot through the chest low enough to hit the liver, and the report of his condition was that bile was being discharged through the wound.

However that may have been, when I first saw him he was suffering from an empyema with insufficient drainage, the result of an infected haemothorax. I enlarged the resection wound and got better drainage, but he was in bad shape. Finally he discharged a putrid mass of tissue through the wound and for a while thereafter parts of his food would be discharged through his back, following the meal. The discharge was not acid or gastric in odor. It later stopped spontaneously. Dr. Osler and our X-ray man examined him by means of bismuth and the fluoroscope, and reported that they could see no abnormality.

I saw three cases with destruction of the upper quarter of the humerus. All recovered with useful arms and one had considerable deltoid action.

When and how often should cases be operated upon?

1. Obviously as soon as possible, so the hospital must be near the front.

2. But once in a half-equipped hospital, the patient will get half an operation, that is, he will get drainage—perhaps partial control of hemorrhage, and probably removal of foreign bodies, for field hospitals are usually working under pressure and circumstances and surroundings are not conducive to thorough work. As a generalization, (1) may be sacrificed to (2), that is, better have the hospital further to the rear, with a longer ambulance ride for the patient, than have him half operated upon in a field hospital, leaving the work to be completed farther back. Critical cases will not survive two operations.

As to abdominal wounds, I doubt the wisdom of the old teaching which advocated leaving them alone, rather than subjecting them to the jolting of an ambulance. Under this plan the only type that would survive would be a few of those with wounds of the large gut. What little hope there is for shell wound cases lies with a fully equipped hospital. Field hospitals would do better to devote their valuable time to many slight cases rather than a few severe ones. In other words it would be better to tax motor transport, rather than cripple the field hospital staff, with bad cases that would render the organization even less mobile.

Fully equipped hospitals as near the front as possible are best. By fully equipped I mean an operating room in a house, portable if you prefer, but with an autoclave, X-ray, a receiving room in which the patient is stripped and bathed, rather than carried, dirty, direct to the operating room.

The wards may be under canvas, but I cannot imagine decent surgical appliances and methods under such conditions, though I admit I would rather have a tent fall on me as a result of shell fire than a house. Again,

an all-wood hospital would be sure to be burned. If canvas is used it must be rendered light tight or fall an easy victim to air raids.

In the area near La Panne, the evacuation of wounded in the majority of instances was impossible except at night. Consequently our cases arrived in from one to twenty-four hours after they were hit. A small percentage, being wounded in an isolated position, did not get in for two or three days. Nearly all had received merely first-aid treatment.

GAS GANGRENE

Gas gangrene is responsible for a large majority of the deaths in this region (La Panne). Early operations saved many, but cases from isolated positions, without surgery for two or three days, were apt to succumb. If a case with gas gangrene survived the third day he was apt to live. The deaths in these cases occur early. Contrary to my preconceived ideas of gangrene. During three months I did not see bleb formation. Extensive discoloration of the skin was comparatively rare and almost always followed by death. Crepitus was considered a late manifestation rather than a very early one. I saw no bloody froth exuded from a wound as I expected. Gas gangrene is a rapidly developing and, without radical treatment, fatal disease, so the earliest signs are the ones which should be emphasized. They are as follows. There is a foul odor when the dressing is removed. It has a peculiar musty quality, sweetish, and is very penetrating. Ill-defined red-brown discoloration of the skin appears in the vicinity of the wound, not unlike the familiar slight ecchymosis, from which it has to be differentiated. These marks are distinguished by a reddish tint sometimes described as bronzing. They spread, and in a few hours become confluent. Either of the above may be the first sign noted. If the red-brown spots are incised, the subcutaneous connective tissue is found pale, with greenish-yellow fat globules projecting through and bathed in dark tinged blood which does not look venous nor yet arterial—but more like postmortem blood. A smear or culture from this blood will quickly confirm the diagnosis which has already been made, if conditions are revealed as described above. A valuable point for prognosis is found in the bacteriological report—whether conditions favorable or unfavorable for the growth of the organism were reported. In the latter case the mixed infection was pretty sure to starve out the gas organism.

If the infection is deeper and advanced, shaving the part will elicit an interesting sign. The razor causes a different sound in passing over the area; the ring becomes suddenly flat as though shaving a drum head. The part may be swollen and is usually tense, more from deep hemor-

rhage than from gas in the tissue. But it is a bad sign, as gas gangrene seems to find a particularly favorable media in blood clot. Incision along the tract of the projectile will reveal protruding blood clot, necrotic connective tissue which is easily picked out and lusterless grayish muscle which does not bleed well. In late cases there will be an audible escape of gas from the depths of the wound. The whole picture suggests an autposy rather than an operation. I am told by a reliable witness that, in the earlier days of the war, at a hospital in southern France where cases were received that had been a long time in transit, upon cutting the bandage the dressing would be actually blown off by the accumulated gas in the wound.

Even a fairly advanced case will show little systemic change—slight elevation of temperature, facies normal, white blood count slightly elevated, most characteristic sign of all a rise in pulse out of proportion to the slight rise in temperature and sometimes pain in the part. In the last few hours of a fatal case the change is rapid. The skin changes in color and becomes bloodless like a cadaver. The patient is moribund with a weak pulse becoming inpalpable.

The staff often mystified me at first by prophesying that a given case would develop gas gangrene before the above early symptoms appeared. They would make this statement for cases that came from Nieuport, and were almost always correct. Again, it seems that shell is most apt, shrapnel next, and bullet wounds least apt to develop gas gangrene, varying directly with the quantity of extraneous material which they may carry into the wound. Viewed from another angle, wounds of the hand never developed gas gangrene; wounds of the face, but one in the history of the hospital. Wounds of the buttock and thigh almost always developed it, the order of occurrence in the body being about as follows: buttock, thigh, leg, trunk, shoulder, arm, forearm and neck.

Wounds of the scortum were fairly common, but none of the surgeons I asked had ever seen gas gangrene develop in that part. It seems that clothing carried into the wound is directly responsible for the infection. The covering of the lower part of the body, being more in contact with the dirt of the trench, is more certain to carry a culture. In sitting, the gluteal region is most impregnated with the dirt.

We had many civilian wounded from the towns, often very dirty physically, having been wounded in their cellars where they fly at the first shell. Gas gangrene was rare among them though, as in soldiers, dirty wounds of the glutcal region were common. Officers developed gas gangrene, but not so often as the enlisted men.

Early and very radical surgery is necessary to cleanse the wound.

Cut out the tissue which bears the macroscopic dirt, and all tissues whose vitality has been impaired. If very dirty, a plug of tissue, say 1½ inches in diameter, is removed *in toto*. Through and through drainage is essential, followed by peroxide irrigation and wet dressing.

Frequent examination of the wound during the first three days is the most important part of the treatment. If gas gangrene develops, cut out all changed tissue and inject oxygen gas into the adjoining tissues, particularly along the fascia planes. The preference of the gas bacillus for connective tissue is most noticeable in these wounds. Spreading from the wound proper, necrotic fascia can be followed along its planes, with contiguous muscle affected only in a thin layer. As far as possible, no overhanging skin edges should be left. The dictum, "make a closed wound into an open one," is excellent. If the gas gangrene spreads in spite of radical surgery, repeat the operation, removing all the newly affected tissues. It is necessary to do this daily or even twice a day for several days. In the case of an extremity amputation may be necessary. In successful cases gas gangrene ceases spreading, giving way to a mixed infection. At La Panne practically all the primary flat amputations developed gangrene between the layers of the flaps, where, of course, ideal conditions for an anaerobe exist. So all amputations were cut straight across the bone at the level to which the muscle retracted, in this way leaving the least possible area for infection, and that fully exposed. Later, when clean and granulating, a flap operation was performed. Gas gangrene in the presence of a compound fracture, or where the circulation of the part is markedly impaired, is a sufficient indication for an amputation.

Aerobic infections are not feared, but are almost welcomed, because the anaerobic gas bacillus does not thrive with them.

A perforating wound should be so cut that it may be described as two cones with apices joining. This sounds pretty radical, but the loss of tissue, or even life, as a result of the spread of gas gangrene, is much worse.

In the field where oxygen gas could not be obtained, atmospheric air, forced through a hollow needle by a Davidson syringe, could do no harm. As to air embolism and the risk of peroxide in sinuses causing the spread of the infection, I saw nothing to suggest either.

A type of surgical glove, used in England and Belgium, was laughed at in the beginning but admired afterwards. It is as thick or thicker than the yellow household variety, but is made of excellent material and has a gauntlet. The fingers are large in circumference, but not long. It is always tight at the finger tips, so knots can be tied with ease. We carried with us regular surgical gloves that are better but do

not last long. Gloves and instruments can be readily sterilized in a mixture of one part glycerine to three parts water, requiring a higher boiling point but affecting rubber and nickel less.

All types of scissors soon become useless unless they are large and very heavily constructed. We never had too many haemostats. Many knives are needed. Very long hinged dressing forceps make for better asepsis, when assistants are not scrubbed up, and are very useful in the wards. The variety with the tip not too large is indispensable for placing drains in long sinuses. At La Panne Dr. DePage has an instrument maker who turns out perfectly made instruments, such as haemostats or scissors.

A lot of rubber tubing is necessary, for use in irrigators, as drains and as tourniquets. In a through and through drain I am fond of cutting one hole about the middle, connecting the irrigator and pinching the other extremity of the drain. By turning it about and moving it a bit up or down it is easy to irrigate all parts from the center outward. In the wards, many irrigating tips, scissors, forceps or small dressing forceps and gloves prevent delay in resterilizing. Silk in two or three sizes in the best all-round suture material for this work. Medium and very heavy are used most.

At the front, leading to each battery or trench, are systems o directing numbers or letters. A sign 4 or 5 inches square nailed to a stake, the whole projecting perhaps 8 or 10 inches above the ground, and wound with barbed wire, so as to make its removal difficult, is used. There was one of these every few feet of the way, guides at night in an otherwise characterless, flat country.

The spiral cloth puttee wears out quickly, is not easily adjusted and it has been criticized by a number of physicians. Many believe the trench frost-bite is attributable to this cause. With marching or long standing the leg increases in size, the puttee becomes too tight and impairs the venous return, which is already taxed. Standing in cold water is another important factor. Belgian troops who did not wear the puttee were little troubled. Of the cases that I saw in England fully 90 per cent showed the following condition. Thousands of men were brought to England with feet so tender that they could not be persuaded to put foot to ground. All that the feet showed was a very slight swelling with slight cyanosis; more often nothing abnormal could be seen. Pain was the most marked sign; it was particularly bad at night. Various methods of relief were tried with little success; perhaps the best was to cover the feet with an ointment. For the pain at night, if advice were given one man to leave his feet out at the foot of the bed, the next night every man in the hospital would have his

feet out, and continue to do so until he recovered. True frost bite did occur, but it was comparatively rare. The recovery of the slight cases was astonishingly slow. After having seen a few cases I should have put it down to malingering, but after seeing so many I am convinced that the pain is genuine. The mild type is not written up to any extent in the medical journals, but is the type that should interest the military, since it is responsible for the loss of effectives, and this not for weeks, but months.

The summer of 1915 the Belgian troops adapted a very low leather legging which came well down over the foot, without a strap under the instep. It laced up the front like a shoe and the lacings were tied to those of the shoe in front over the instep. It extended but little higher on the leg than the ordinary shoe, just enough to keep the trousers from flapping, and allowed ample ankle motion.

All the troops that I saw wore a heavy shoe with hob nails, a bit like a brogan and too large rather than too small. No cheap shoes were satisfactory. The Italians wore a heavy high shoe like a hunting boot, laced up the front. Most of the continental troops carry an extra pair of shoes under the belt.

The brassard that is supplied always wrinkles up on the under side of the arm. It soon looks like a dirty rag. The device used by the British R. A. M. C. is much better. It consists of a disc about 2¼ to 2¾ inches in diameter with a red cross measuring about 1¼ inches.

In days of motor transports even paved roads require constant care. At intervals, roads are obstructed to insure control of autos that would otherwise go through at too high speed for inspection by sentries. An abuse of headquarters machines was stopped by taking the numbers of cars every time they pass certain points and reporting to commanding officers. Following this, the roads became much clearer and safer toward Dunkirk and Calais.

Chauffeurs of military transport should have dispatch cases with transparent pockets for military passes hanging from the shoulders, as they have to show their papers very frequently.

Between Dunkirk and Adinkerque is a distance of about 7 miles. It was a main supply line with a lot of transports and averaged about two collisions a day, mostly due to drivers unaccustomed to the work, and the narrowness of the road. The old-timers were not particularly careful and drove fast (at least 35 miles an hour), but had few accidents.

The peasant population caused most of the obstruction and accidents. Horse-drawn vehicles come next. Small detachments of troops usually march in thin columns at the sides of the road and do not obstruct the way. I have never seen any large detachment marching,

and I am sure that motor transport is provided. From La Panne to the front they usually march, as main roads were few and there was a shorter way across the country. Several soldiers told me that during the retreat from Antwerp they marched over 40 miles and slept in the open at the end, and were very glad of that opportunity.

At La Panne the Belgian troops were quartered in private houses. A layer of straw formed their beds. The straw was frequently replaced, the old being burned to the accompaniment of the popping of cartridges. I never saw an accident result from this. Tents are almost never seen. During cloudy or wet weather the odor of the ground in the vicinity of the men's quarters is very strong of urine. The men always smell badly. Except in extreme weather the troops are sent into the surf, bathing by companies. Life guards are provided. Dr. DePage, in his effort to decrease the incidence of gas gangrene, established a hot water plant with twenty tubs, said to accommodate 500 a day at the rate of 20 minutes to the bath. Meanwhile the clothing was sterilized to kill vermin, mended, and new underclothing issued.

The commissary department was not at all in evidence; one would occasionally see portable kitchens in back yards. The men got soups and stews mostly. The kitchens were very simple in construction and on wheels.

The enlisted men have decorations, I should say one to every two or three hundred men. They are so proud of them that I am sure that they have a good effect. Discipline is lax in minor matters, and very severe as to self-inflicted wounds, malingering, and assaults on women. There is very little drunkenness. Some effort is made to provide amusement, but the Belgians do not take to athletic games.

Like the French, they wear overcoats in all but extremely hot weather. Perhaps it is the easiest way to carry them, as they already have all the pack that can be adjusted upon them.

The trenches are dirty and full of vermin. Rats abound. The covered type of trench is particularly odorous. I did not visit enough to be sure of the latrine arrangements, but I am told that they are crude or non-existent.

A LABORATORY OF EXPERIMENTAL SANITATION AT THE M. O. T. C., FORT RILEY, KANSAS

By Major DANIEL M. SHEWBROOKS

Member Reserve Corps, U. S. Army Instructor in Sanitation, Fort Riley, Kansas

(With two illustrations)

THE creation of a great National Army has necessitated the calling into the service of thousands of civilian doctors who are sent out to take the responsibility of safeguarding the health of our new armies after a few months of intensive training at the various medical training camps.

One of the most important features of this training is to instill an intimate knowledge of the best sanitary procedures, both for camp and field use, which procedures it is believed should be placed upon a definite regulation basis, free from make-shifts and the inexperience of the local quartermaster or sanitary authority.

The civilian physician's ideas on sanitation, as applied to the army, undergo a radical change upon entering the service. He has to forget for the time being that he is solely a reliever of human ailments and, with an open mind and a wholly new point of view, must reorient himself upon his fundamental college and medical education. The new ideas imparted to him must take shape in a minimum space of time and their practical application must be made to conform as far as possible to a uniform standard, founded upon sound and tried principles. But it must be remembered that the doctor, like the man from Missouri, "has to be shown." Text-books and lectures are not enough—he must "see the fire burn and the water boil."

Early in August, the need of a sanitary laboratory at Fort Riley for teaching and experimental purposes, was clearly realized. Men were of necessity sent out from the training camp who had not had the advantages of first-hand knowledge of many of the old appliances and new departures in field and camp sanitation, except that gained from text-books, lectures and tours of inspection, which often illustrated them in a very limited and unsatisfactory manner.

The difficulties in establishing such a laboratory were many: land and unskilled labor were cheap and plentiful, yet there was no one at that time among the Reserve Corps at Fort Riley who had had a wide experience in such an undertaking. There was no appropriation available. Building material was scarce. The literature was widely scattered and difficult to obtain. That which was available was often indefinite in the accurate descriptions and specifications of apparatus.

Faced thus by the problem of producing a model of the sanitary defenses against disease and filth under such difficulties—a problem which, in actual practice, every medical officer is liable to face—our laboratory *was* established and now occupies a considerable area of ground on the site of a former casual camp, some 200 yards north of the old Post Hospital.

The old casual camp kitchen and storehouse, which had been left standing, was fitted up as a model permanent camp kitchen. Especial emphasis was laid upon the following points: all tables and woodwork so constructed as to allow ready access of the scrubbing brush to all surfaces coming in contact with food stuffs; absolute cleanliness on the part of all cooks and attendants; daily oiling, and sprinkling with fresh sand, of the kitchen floor and the surrounding grounds within a radius of 20 feet; no screens.

Where the above conditions prevail, flies are a negligible factor. In close proximity to the kitchen is the new army field range, No. 2, with all its utensils nested inside. An improvised field ice-box is built into the bank on the north side of the kitchen. From a nearby tree hangs a swinging cage, such as is described in the Manual for Army Cooks.

The several varieties of improvised field ovens—the open trench for baking, a bean pit, an oven in a hill side, a mud oven and a mud range—were built by enlisted men under supervision. The improvised camp kitchen as used by the English, and figured in Lelean, was constructed and has caused considerable interest among members of the Fort Riley School of Cooks and Bakers, where a similar kitchen, it is hoped, will be built and tried out. Other mud ovens, as devised by the School of Cooks and Bakers, are in process of construction.

The field kitchen exhibit has been recently enriched by the addition of the Field Oven No. 1, and a Russian wheeled soup-kitchen.

The disposal of waste water and kitchen sullage water is shown in the two types of apparatus figured in Lelean—"A Strainer, Grease Trap and Soakage Pits" and "A Soakage Pit for Kitchen Sullage." It is further illustrated by a Guthrie type of incinerator, together with a modification of the same.

An interesting combination of incinerator, hot water heater and evaporator for waste water was devised by Lieut. Col. W. W. Reno, M. C. U. S. A., and Private Kenyon, of the Oklahoma National Guard. The heat from the incinerator is utilized in heating a hot water coil which leads to a large cement-lined brick tank. The wash water from men washing their hands and faces, cleaning their mess kits, etc., is emptied into a concrete lined trough surrounding two sides of the base of the tank. The trough catches the inevitable drip following each

SANITARY CENTER. SCHOOLS OF APPLIED SANITATION, M. O. T. C., FORT RILEY, KANS., 1917.

Shows working models made to scale of various types of sanitary appliances, model tent kitchen in war. Blackboard showing statistics, charts, life cycle of insects, etc., in background.

To face page 180.

ANOTHER VIEW OF SANITARY CENTER, SCHOOL OF APPLIED CAMP SANITATION, MEDICAL OFFICERS TRAINING CAMP, FORT RILEY, KANSAS.
About sixty different sanitary appliances and types of apparatus are demonstrated in this center.

SANITARY CENTER. SCHOOLS OF APPLIED SANITATION, M. O. T. C., FORT RILEY, KANS., 1917.

Shows working models made to scale of various types of sanitary appliances, model tent kitchen in war. Blackboard showing statistics, charts, life cycle of insects, etc., in background.

To face page 180.

Another View of Sanitary Center, School of Applied Camp Sanitation, Medical Officers Training Camp, Fort Riley, Kansas.
About sixty different sanitary appliances and types of apparatus are demonstrated in this center.

drawing of hot water. The waste water is drawn into a shallow pit in the front part of the incinerator, where it is rapidly evaporated by the intense heat brought close to the surface of the water by means of a deflecting arch.

Many different patterns of accepted incinerators have been built and several new ones developed. Among the former may be mentioned: the Guthrie, a modified Guthrie rock-pit, Reno-Kenyon as mentioned above, Horse-shoe, Straub, Caldwell, Alamo, Cross trench and circular hearth incinerator, the Richardson incinerator; and combined open rock incinerator and sullage pit.

Especial mention should be made of a large Panama railroad iron incinerator, for manure, requiring the use of over 10 tons of old rails, loaned by the Union Pacific Railroad.

The disposal of human excreta is such an important problem confronting the medical officer, especially in the absence of a general or central system of sewerage, that special emphasis has been laid on the construction of those types of apparatus which will be easy of construction with the materials at hand and yet at the same time be absolutely efficient. Among those shown are straddle trenches, a urine soakage pit, a portable latrine seat, deep trench fly-proof latrine, improvised latrines for first line trenches, improved Lumsden, Roberts and Stiles sanitary privy (public health), and the McMunn for infective solids and liquids.

A company sink with a pole seat was constructed—the type so extensively used in the Civil and Spanish-American wars. This type stands out in sharp contrast to the above types, illustrating admirably the points that a good latrine should not have.

A fly-breeder enables one to study the complete cycle of the common house fly, while the various mechanical methods for its destruction are shown in the different types of fly-traps.

A drying platform for manure before incineration and the large Panama railroad iron incinerator, above mentioned, are among several illustrating the disposal of manure.

Special attention is being paid to anti-vermin measures. Only recently an opportunity was given for the practical demonstration of the Serbian barrel when the clothing of several prisoners was most successfully de-loused. At present a large de-lousing chamber, modelled after the one used so successfully by the Canadian sanitary units, is in the course of construction.

The problem of supplying hot water in sufficient quantities for cooking, bathing and washing purposes is solved in varying degrees, by several types of apparatus—the Saville water heater, used so successfully

at El Paso; the Reno-Kenyon incinerator, with its hot water attachment. Some of the waste heat of a Guthrie incinerator is utilized in heating a hot water coil placed beneath the pan and leading into a barrel.

One of the features of the "English improved oven" is that one of its furnaces is utilized entirely in heating water.

Several large blackboards have been arranged in a hollow square graphically illustrating: malaria in penal colony (Celli); efficiency of quinine prophylaxis; malaria in Italian army; drawings of the larvae and adult anophales and culex mosquitoes; drawings of the house fly; charts of fly-borne diseases; typhoid and flies at Mhow; typhoid cases traced to direct personal infection, showing stage at which infection was conveyed; agglutines as a result of anti-typhoid inoculation; typhoid in India and in the United States Army; ratio between sickness and mortality in the British wars of the last thirty years; results of sanitary efforts in the Army, 1903-1912; energy balance sheet for eight hours; water needs on the march; diagram showing sanitary arrangement and system of food and water supply of troops in France.

The course of instruction is made as practical as possible. The construction, uses, advantages and disadvantages of the different types of apparatus are carefully explained to small groups of students at the completion of their course of lectures in hygiene and sanitation. They frequently see many new pieces of apparatus in the course of construction, and others in actual operation. These same demonstrations are being rapidly extended to the enlisted medical personnel.

To be certain that the student thoroughly understands the essential points of construction, he is requested to hand in a detailed drawing and description of representative types of apparatus.

The realization of the benefits of this laboratory to the student medical officers has caused Lieutenant Colonel Bispham to extend its privileges to the medical officers at Camp Funston. It is to be hoped that medical officers from others parts of the country, as well as line officers, may have the advantages of a course similar to the one given here.

The very number of incinerators that have been devised in the past few years is proof that no one of them is entirely satisfactory. At the present writing the interest of the laboratory is centered upon the utlization of the waste heat—a factor of especial importance in the present war, where fuel is playing such a large rôle.

A type of incinerator embracing this feature has been devised by Major Williamson and put into successful operation. It is especially adapted to such organizations as are immobile. Another type devised

by Major Williamson is in course of construction. A new portable latrine has been devised. The question of the utilization of the waste grease and fats from the camp kitchens and grease traps, together with the ash from manure, is being investigated. Many small improvements have been made on old apparatus.

Work is being carried on out of doors as long as the weather permits, but a large hospital ward tent has been comfortably fitted up to carry on numerous new lines of endeavor during the winter and inclement weather.

As a natural outcome of the difficulties experienced in obtaining the literature and specifications of the many pieces of apparatus, it was considered advisable to have a complete set of blue-prints made of each piece of apparatus constructed, together with an accurate description and specifications in order that they might be available not only for the medical officers at this camp but throughout the army. These have been made and, at a request from Washington, a complete set has been sent to the Surgeon General's office.

In the past four months an exhibit has been produced which is a credit both to the training school and to the service. It received much favorable comment from the French and English commissions on their recent visit to Fort Riley. The success of this work is largely due to the resourcefulness and untiring efforts of the director, Maj. Charles Spencer Williamson, M. R. C., who, together with his associates, Maj. Daniel M. Shewbrooks, M. R. C., Capt. William W. Pretts, M. R. C., and Lieut. David Schmalhorst, M. R. C., are endeavoring to make the scope of this laboratory entirely practical.

EDITORIAL

WHY THE MORBIDITY AND MORTALITY STATISTICS OF OUR CAMPS ARE SATISFACTORY

In 1903 Koch wrote: "It is well known that typhoid is one of the most dangerous of the diseases which appear in war time," and adds, "In the Franco-German War we had 73,000 admissions and 9,000 deaths from it." It will be recalled that the British had something over 50,000 cases during the Boer War with 5,877 deaths, while it is estimated that in 1898 we had 20,000 cases with 1,580 deaths.

As a result of Koch's masterly investigations, in 1904 the Germans began the systematic use of antityphoid vaccination in their army, another instance of the Teutonic capacity to recognize a good thing when it presents itself; for it was an officer of the British Army Medical Service, Sir A. E. Wright, who in 1898 introduced the practice of immunization in British soldiers serving in India.

Our own medical officers were not slow to appreciate the stupendous possibility of eliminating typhoid as a cause of non-efficiency in the United States Army. The vision was there, but it was not until 1909, when Major, now Colonel, Frederick F. Russell, of the Medical Corps of our Army, presented the matter so convincingly that the Medical Department authorities took it up and, backed by the influence of the civil profession, was able to induce the War Department to authorize a voluntary test—but upon the members of the Medical and Hospital Corps only.

Colonel Russell's views and recommendations were formulated in the following "conclusions" published in THE MILITARY SURGEON.[1]

1 Typhoid fever can be stamped out by an aggressive campaign in which the sources of infection are traced by modern methods.

2 This disease is practically contagious and the patients should be isolated and routine disinfection should be carried out, not only until they are convalescent, but also until they have ceased to excrete bacilli.

3 The correct diagnosis at the earliest possible moment, of all cases, is of prime importance to the sanitarian. Earlier diagnosis can be made by blood cultures than by the agglutination test, or by clinical signs.

4 The diagnosis of mild and ambulatory cases is of the greatest importance for the sanitarian.

5 In time of war, when we have to deal with large numbers of new and untrained men, vaccination against typhoid, of the entire army, is the most promising way of keeping down the non-effective rate due to this disease.

[1] Vol. xxiv, p. 518, June, 1909.

6 In time of peace, especially before the summer maneuvers, as many volunteers as possible, from the Hospital Corps, should be vaccinated.

7 Vaccination should not be confined to the Hospital Corps, but an opportunity should be offered to every one in the service to be vaccinated.

8 This procedure has already been carried out on 35,000 men, without any untoward result whatever and with magnificent results as regards protection.

The propaganda progressed slowly but surely, volunteers throughout the service submitted themselves willingly and, in course of time, so many were protected that a decided impression was made on the morbidity rates of this once dreaded disease. Finally convinced, the War Department issued orders requiring recruits to be immunized and, at length, with the mobilization of 1916, antityphoid vaccination was made compulsory for all, with the result that typhoid was practically non-existent among the troops on the border.

Then came the call to the nation to arm and, even now, many hundreds of thousands of our citizens are assembled in various camps scattered broadcast over the country; young men, the flower of the race, and at the most susceptible ages for typhoid fever. *But there is practically no typhoid in our camps.*

Surely there must be some special cause for this. Nothing in the current history of existing camps would lead us to believe that in them could be found any intrinsic reason for the absence of typhoid. No doubt the army generally, and the public, have advanced somewhat beyond the ideas of 1898. There has been a great campaign of education since then, both within and without the service; still measles and pneumonia, meningitis *id genus omnes* are in the camps, but not that most dreaded of all camp diseases—typhoid. Why? Because Russell had the vision, training, ability and persistence which enabled him to convince our military authorities, and finally the people, that antityphoid vaccination, properly conducted, would eliminate typhoid fever as a nosological entity.

Let us for a moment assume that such elimination had not taken place, and the personnel of the Army was equally susceptible to typhoid as before the requirement of antityphoid vaccination, what would probably have been the present condition in our camps?

The admission rate for typhoid for our army in 1898 was 141.59 per thousand. It is reasonable to assume that this does not represent the real typhoid incidence, admission rate being an uncertain diagnostic quantity. But the average admission rate for the decennium would be a fair index and that was, in round numbers, 21 per thousand. Assuming that sanitary progress had been so general throughout the country since 1898 that, even had there been no antityphoid vaccination,

the typhoid incidence in our camps would be 21 per thousand—a modest assumption—we would today be treating approximately 21,000 cases of typhoid fever in our military hospitals, of which 2,100 would die.

That we are not treating many more thousands than this estimate and that the usual percentage of such cases have not died is, in the opinion of THE MILITARY SURGEON, wholly due to compulsory antityphoid vaccination in our Army.

The Medical Department of the Army was the moving factor in producing this beneficent result, which has already added thousands to the fighting effectives of our forces, and Col. Frederick F. Russell, M.C., U. S. Army, furnished the impulse which led to the introduction of antityphoid vaccination as a compulsory practice in our service. This practice is now, slowly but surely, extending to the civil population and, in due time, typhoid will cut no greater figure in our mortality statistics than does smallpox.

Certainly Russell deserves well of his country, and a thoughtless, though really grateful, republic should acknowledge its deep obligation to him in some substantial way.

THE MILITARY GENERAL HOSPITAL IN WAR TIME

The Manual of the Medical Department sets forth, among other reasons for the organization of general hospitals in peace times, the formation of "a nucleus for the development of the larger hospitals required in the home territory in time of war." The regulation might well have read "nucleoli," for two permanent army general hospitals, accommodating possibly five hundred patients, must now expand into hospitals to care for several hundred thousand patients.

The Medical Department is, as rapidly as may be and almost entirely dependent upon construction (a function of the Quartermaster's Department), organizing accommodation for our prospective patients into units of a thousand beds, and it is to the management of such a unit we would refer.

The personnel of this hospital should be approximately 50 medical officers, 166 noncommissioned officers, 234 sanitary troops, and 100 nurses (females). Quite likely there would be men attached from other branches and possibly some civilian employes—altogether 600 persons, the usual allowance for this number of beds.

The plant of such a hospital consists of fifty-two buildings, as follows:

One administration building; 1 officers' ward; 2 officers' quarters; 1 nurses' quarters; 1 eye, ear, nose and throat laboratory; 1 operating room; 1 exchange, garage, and shop; 1 eye, ear, and X-ray laboratory;

1 hospital mess room and kitchen; 1 receiving ward; 16 single wards, of 32 beds each; 8 double wards, of 72 beds each; 3 isolation wards; 6 barracks and 2 laboratories, mess room and kitchen for personnel; 4 storehouses; 1 chapel, mortuary, and guard house; 1 laundry; 1 fire-engine house; 1 psychiatric ward; the names of which sufficiently indicate their functions.

Regulations suggest that a base hospital is to be commanded by a colonel or lieutenant colonel of the Medical Corps. Not so many of our officers, even of this rank, have had personal experience in the immediate control of 1,600 individuals and the direction of a military general hospital of these proportions. But those of the permanent force are at least trained in the principles of command.

The commanding officer, whoever he may be, is fortunate in the fact that he will not now, as in our former wars, be forced to evolve from his experience and imagination the general details of organization, as these are set forth in the Manual of the Medical Department, but he will have a stupendous amount of filling in to do before he establishes a going institution.

Of course, as everyone knows, the first thing to organize is the administration and, thereafter, to assign every individual to specific duties, establishing a well-defined line of responsibility from the commanding officer to the *n*th private.

The manual indicates some of the duties to be done and the offices to be filled, in a smaller hospital. For larger hospitals the increased responsibilities, and number of personnel and patients, would demand higher rank and more of it. The thousand-bed hospital should have a personnel, commissioned and noncommissioned, or the equivalent in the nursing force, equalling that of a regiment of infantry, viz., 50 officers and 166 noncommissioned officers. No argument is necessary to support this proposition. If 50 officers and 166 noncommissioned officers are required to manage the 1,600 well men, more or less, of a regiment, such are equally needed to care for the same number, a thousand of whom are ill; for ill soldiers require officers and noncommissioned officers quite as much as well men.

The hypothetical commanding officer is fortunate if he has the knack of fitting his personnel into congenial places and keeping it loyally interested in the work. But whether fitted or not, the work must be done and the hospital conducted upon the highest plane of efficiency. Only the best disciplined personnel can produce this result and, in a soldier organization, this discipline must be military. Every officer, man and woman, should be right up to the line every minute, neat, soldierly, polite, efficient. With such a detachment the hospital

is bound to be efficient, but a detachment will never be efficient spontaneously; it must be made so by ceaseless effort.

The organization of the various departments, one of the most important of which is the kitchen, would follow the lines laid down in the manual, and each of these should have a duly designated responsible head, who, after he has been instructed, should be little interfered with if making good and, if not, should be relieved. This is no time to fool with inefficient material. Trained initiative should be encouraged, but it must be "trained" and the "get there just the same" way of doing things discouraged.

After the commanding officer has his hospital running to his moderate satisfaction, and this will take almost twenty-four hours daily of his time for many weeks, he will be fortunate if he has the tact and opportunity to organize the neighboring civil community into a reasonably disciplined adjunct to his command. With the adjacent citizenry at his back, there are no limits to the good that could be accomplished for his patients.

A well-ordered woman about the hospital, even though not especially trained, could be a mighty help and, before the war is over, we will need the help of all well-ordered women the country can spare. So a good understanding with the neighbors would be a real asset to a militry general hospital and might well take the form of a properly directed woman's board of visitors.

But such assets will not be available unless the community is satisfied that the hospital is efficient, and of this it cannot be unless it is convinced that the hospital staff, commissioned and enlisted, is thoroughly disciplined and loyally devoted to its work.

The endless details of interior economy will be an unceasing cause of solicitude to the commanding officer until his team is well organized and in running order, and thereafter even, will require his constant, tactful supervision.

It goes without saying that there should be a designated place for everybody and thing, set forth specifically in orders. Nothing shatters faith in such an institution more than to have an outsider inquire for a particular patient and be long delayed in ascertaining his location. A card index of patients, kept up to the minute, should always be in the information department; as should such an index of the personnel be in the personnel department. Strict care should be taken of patients, effects if scandal is to be avoided.

The hours for visiting should be prescribed and only departed from in special instances by authority of the commanding officer of the hospital,, or other officer designated by him. Apropos to this the public press has

recently dwelt upon the action of the chaplains of a certain Division in relation to the Division hospital. THE MILITARY SURGEON knows nothing of the merits of the case and regrets the occurrence. Chaplains can be made a valuable adjunct to a hospital if properly controlled; they, of course, have nothing more to do with the conduct of it than the surgeon has to do with their chapels, and it might seem that these particular chaplains should be court-martialed for conduct prejudicial to good order and military discipline. Chaplains should not be permitted to chase over the hospital at any and all times, any more than other outside officers, but should visit during the prescribed hours; unless there be a particular reason otherwise, which then should be determined by proper authority.

This incident but illustrates that the commanding officer of a general hospital (this happened to be a division hospital), among numerous other things must be "wise as a serpent," tactful to a degree, a great physician, a fine organizer and administrator, an excellent disciplinarian, thoroughly competent to run a large hotel, wholly equal to the command of a regiment, and therefore a good soldier.

Of course very few men possess all these attributes, but he who would successfully conduct a great military hospital must possess most of them, for upon him will depend 75 per cent of the efficiency of his command. "*En y pensant toujours*" was Napoleon's reply to one who asked him how he was able always to decide certain matters so quickly. An admirable motto for a general hospital commander, who should always be thinking about his command and how to promote its efficiency.

THE FOURTH TABLET

Professor Keen's beautiful tribute to the Officers of the three public medical services,[1] brings to mind the fact that there is a fourth tablet, erected in the Chapel at Fort Leavenworth, Kansas, by the medical officers of the Army. It bears a three-fold inscription:

IN MEMORY OF FIRST LIEUT. GEORGE E. LORD, ASSISTANT SURGEON. KILLED IN ACTION WITH SIOUX INDIANS, LITTLE BIG HORN RIVER, MONTANA, JUNE 25, 1876.

IN MEMORY OF FIRST LIEUT. THOS. J. C. MADDOX, ASSISTANT SURGEON. KILLED IN ACTION WITH APACHE INDIANS, WHITE HOUSE, NEW MEXICO, DECEMBER 19, 1885.

IN MEMORY OF THE ACTING ASSISTANT SURGEONS OF THE U. S. ARMY, WHO HAVE FALLEN IN LINE OF DUTY IN THE SERVICE OF THEIR COUNTRY. R. I. P., A. D. 1889.

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[1]THE MILITARY SURGEON, January, 1918.

ASSOCIATION NOTES

A meeting of the Executive Council was held at Washington, D. C., January 21, 1918, for the transaction of such business as should be brought before it.

Reports were submitted by the secretary and treasurer, detailing the work of their respective offices and showing a very satisfactory condition of the affairs of the Association.

Lieut. Col. Joseph A. Hall, M.C. N.G. U.S., was elected first vice-president to fill the vacancy in that office caused by the death of Surgeon General Henry Allers, N. J.

In accordance with a resolution adopted at the last annual meeting, accepting the principle of a proposed amendment to the constitution establishing a Sinking Fund and making it immediately effective, the following named were elected as members of the Savings Committee: The president, the treasurer, and former presidents Hoff, Wise and Blue.

The secretary submitted the applications for membership by 1,120 medical officers who had been found qualified, and who were duly elected active members of The Association of Military Surgeons of the United States, and one officer of the Sanitary Corps, associate member, as follows:

Medical Corps, U. S. Army

Major

Geo. B. Lake
John T. Reddy

United States Public Health Service

Assistant Surgeon

Charles E. Gibbs

U. S. Navy

Assistant Surgeon

C. C. Ammerman

P. A Surgeon

Reynolds Hayden

Surgeon

Harold D. Meeker

National Guard (U. S.)

Major

Edgar C. Barnes
John M. Birkner
John Russell

Captain

John E. Armitage
Harry J. O'Bryan
Robt. W. Blumenthal
Neil McLean

First Lieutenants

Lee B. Greene
D. L. Hibberd
Johnston H. Kerr
Chas. E. Schwartz

Associate Member

Captain

John K. Reinoehl

Medical Reserve Corps, U. S. Army

Majors

Francis J. Adams
Walter M. Brickner
Lloyd V. Briggs
Thomas J. Burrage
Roy B. Canfield
Robert H. Duenner
William T. Elam
John B. Elliot
Arthur W. Elting
J. Birney Guthrie
Robert H. Halsey
W. W. Hamberger
Seale Harris
John R. Hereford
Christian R. Holmes
Walter A. Jayne
Kerwin W. Kinard

Majors—con't.

Walter F. Leech
Howard Lilienthal
Mark E. Lott
William H. Luedde
Thomas R. Marshall
Guthrie McConnell
Irvy L. McGlasson
Alexander Nicoll
F. W. O'Donnell
Harry R. McKellar
George Osgood
Daniel M. Ottis
Francis W. Palfrey
Nelson M. Percy
Reuben Peterson
W. H. Rockwell
Llewellyn Sale
O. M. Schwerdtfeger
John M. Swan

Majors—concl'd.

R. W. Van Wart
W. F. Wesselhoeft
William H. Wilder

Captains

E. Stanley Abbott
J. Newton Alexander
A. Alguire
Ira A. Allen
Lewis M. Allen
Jere A. Allis
Harry M. Andrson
Henry G. Anderson
Carl Asehenbrenner
Reuben J. Atwood
Arthur C. Bachmeyer
Alfred E. Bants
Fred W. Barger
Stephen H. Baxter
Lynn S. Beals
A. J. Benedick
Gordon Berry
William H. Betz
John A. Bortz
Fred P. Bowen
Albert J. Bower
Harry Brady
Frank W. Brodrick
Thomas C. Brooks
Henry R. Brown
Claude P. Brown
Edwin T. Bruce
Edmund R. Brush
Frank D. Burgess
Victor Cadwell
Herbert Caldwell
Charles E. Cantrell
Paul F. Cavanagh
Orville R. Chadwell
Louis H. Chamberlin
Henry M. Chapman
Miles D. Chisholm
C. R. Christenson
Orton H. Clark
I. Ross Clark
Joseph J. Clarke
William F. Clary
Mitchell C. Clokey
Arthur L. Cludas

Captains—con't.

Robert M. Coleman
Thomas K. Conrad
W. W. Cornog
John E. Countryman
Sylvester D. Craig
William H. Crowell
Murdoch Lee Crum
Clyde L. Curll
Thomas B. Curran
William T. Daly
Albert K. Detwiller
William W. DeWolfe
Charles T. Dulin
William H. Dunham
Frederick Dunn
Richard G. Eaton
Samuel I. Eber
Carl Eggers
Francis J. Eisenman
James F. Elder
Roderie S. Elliott
John Dean Elliott
Charles E. Elliott
John A. Farrell
Erasmus D. Fenner
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George G. Hunter
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Robert G. Ward	John P. Wheeler		

SURGEON GENERAL THOMAS H. GOODWIN, R. A. M. C.

The Military Surgeon extends its congratulations to an Honorary Member of The Association of Military Surgeons U. S., a distinguished representative of his own service, and a medical officer *par excellence*, upon his well-earned promotion as Deputy Director General, R. A. M. C.

General Goodwin, early in his military service, which began in 1893, earned the D. S. O., an auspicious beginning foreshadowing a career which for twenty-five years has been an inspiration to all medical officers. During the present war our colleague has demonstrated his possession, as well, of high administrative qualities, which have received recognition by decoration and promotion and have placed him among the first of his corps.

All these honors we glory in, especially because we know him and regard him as a personal friend and comrade, who has shared our thoughts and aspirations, who has helped us by his modestly given advice, so professionally sound, and by his soldierly example.

The pages of The Military Surgeon bear evidence, in papers which General Goodwin has so kindly contributed, of the impetus he gave to medico-military organization and efficiency in our Department, during his sojourn in the United States, an impetus which has placed all our people, and especially his fellow-members of The Association of Military Surgeons of the United States, under obligations to him.

COMMENT AND CRITICISM

THE REPORT OF THE SURGEON GENERAL, U. S. ARMY, 1917

The one-hundredth consecutive annual report of the chief of our Army Medical Service has just reached the editorial desk and stands *facile principes* amidst its century of fellows.

The delay in its appearance, due to causes which are obvious, has whetted our anticipation and the realization has quite equalled our expectations. This book is a liberal education, and should be placed in the hands of every medical officer with the admonition to "read, mark, learn and inwardly digest" its informing contents.

It will be recalled that the report covers the calendar year 1916 (and the fiscal affairs of the Department to June 30, 1917); it therefore embraces an account of the exceedingly valuable experiences gained during the general mobilization at the border.

The Military Surgeon often wonders if our people realize how priceless to our country that experience was. There are some rumblings and groanings amidst our nation in arms today, but in comparison with what there would have been, save for our border experience, they are but a gentle lullaby to the roar of a stormy ocean, so smooth was the transition from a state of profound peace to that of active warfare. Moreover, the work of the Medical Department was a large factor in smoothing the way and the report well says: "The services rendered by the officers of the Medical Corps have been highly satisfactory in all respects, administrative as well as professional, and have entirely justified the commendation made by their superiors, in official reports," special emphasis being placed on the results accomplished by the medical officers, regular, reserve and militia in Mexico and on the border.

To the great war there is but a pointed allusion. The declaration came April 6, 1917, shortly after the close of the period covered by the report, and fortunately found the Medical Department with its plans for mobilization well in hand. The report gives "as evidence of the unprecedented expansion of the activities of the Medical Department of the Army" that, at the date of going to press, "there were more than 13,900 officers engaged in the work of the department, including those of its various corps," and held out the prospect of many thousands more before the conflict ends.

Notwithstanding the more than doubling of the numbers of individuals upon which the statistics of the Surgeon General's Office are

usually based, it appears that the health of the forces was quite up to the standard recently established in our service.

The mean strength of the command was 176,803; its constantly non-effective rate was 24.26 per thousand, of which 20.55 was for disease, *slightly below that for the previous year* of profound peace. The death rate was 4.39 against 4.45 for the year 1915, the discharge rate higher—15.22 compared with 14.06; and the admission rate also higher—858.87 and 726.22.

While no widespread epidemic occurred anywhere in the command, wholly due, we believe, to the fact that there were trained medical officers on duty in all administrative positions, there were local threatenings and outbreaks, prototypes of the larger threats now making and due to like causes. Typhoid and its fellows, malaria and variola, are no longer the dread of the military sanitarian, as evidenced by the report. Measles and its sequelae are still with us, demanding their toll, and the hookworm is here to help them along. One thing this war will certainly do: it will enable several hundred thousand of us to get rid of the long entertained ankylostoma and maybe influence our civilian friends to do likewise.

As stated in a previous review, the Army and Navy have probably reached the irreducible minimum in non-efficiency due to venereal diseases. Our forces come from the people and, if half the people are venerealized, which seems to be the case, we can't hope to more than half reduce the civilian rate, in our services. The report expresses the hope that "recent legislation giving to the Secretary of War and the military commanders authority to control . . . the civil community adjacent to army commands, in all matters relating to prostitution and the sale of alcoholic drinks, will do much to bring about the desirable conditions long sought for by army sanitarians." Perhaps so, nothing in history justifies this hope, or the neglect of the prophylactics thus far so successful in reducing military non-efficiency from venereal diseases to the present minimum.

The account of the administrative, supply and educational activities of the department is interesting and inspiring. "The Army Medical School has had the most important and successful year in its history and has experienced a development and expansion quite beyond the thought and purpose of its founders." The Military Surgeon can heartily endorse the statement that this admirable organization has proved its value to the country and "the Government should no longer hesitate in providing it a permanent and modern home of its own—one that might quite possibly, with advantage, be made sufficiently large to house also the library of the Surgeon General and the Museum."

What an opportunity for some philanthropist to build himself an enduring monument like unto that of Smithson!

We would go even further and say that such a combination would be immensely advantageous to the Medical Department, the profession and the country. With our present organization, our school must be extended to embrace professorships in military dental and veterinary medicine as well, with laboratories for these specialties. Then, too, the Museum should grow stupendously in extent and worth, as the result of the present war, while the library must keep pace with it in every respect.

The Library of the Surgeon General's Office is now really an international institution, its index catalogue, up to the minute, is indeed the index of every medical library extant and is invaluable to the profession everywhere, while its books, the largest collection of medical literature in the world, are available to all, under the simplest restrictions. Surely these invaluable collections should not be housed inadequately or subjected to the risk of irreparable loss by fire.

The report refers, necessarily briefly, to the valuable work which has been done by our medical observers abroad, which has proved "of great assistance to the War Department and of particular advantage and satisfaction to the Medical Corps."

THE MILITARY SURGEON shares the regret of the Surgeon General that more medical officers "could not have been spared for duty abroad in the early months of the war." Most useful experience might have been gained by a considerable number of our officers through attachment to Red Cross Units, had the authorities but authorized it. Many valuable papers have been received from our observers, of which THE MILITARY SURGEON has been permitted to publish some and wishes it might be allowed to publish more.

The great lesson of the report is found in the documentary history of the mobilization of 1916, and the Mexican expedition, particularly the former, for the experience gained there, as previously stated, has proved an invaluable asset, in the far greater mobilization of 1917. Indeed it probably hastened its full consummation by a year.

We would wish to go deeply into the details of this history, to discuss the immensely instructive reports of the principal medical officers, to bring to the attention of our readers the wealth of experience therein set forth, but to do so would detract from them, for they must be read in entirety to appreciate their full value. The statistical tables of the report, which show a distinctly satisfactory state of health in the services, are particularly valuable at present, in determining a standard for the

years of active warfare now before us. The only element in which we must look for a material change is in wounds of war.

By the way, let us hope that our statisticians will refrain from any comparison between wound statistics and those of disease; they bear about as much relation to each other as a "green cheese" does to the moon. Originally introduced, before physicians were authorized in armies, to convince the authorities that disease is quite as large a factor in military non-efficiency as wounds, and that, therefore, it is quite as necessary to employ physicians in an army as to employ surgeons, it has been used, in modern times, chiefly as a scourge to apply to the long-enduring back of the Medical Department because of its inability either to induce the fighting department to get into the fighting game, or to properly care for their men when not fighting. Of course there is absolutely no common ground of comparison between the two causes of non-efficiency; both are inevitable and our only ambition should be to reduce them to the lowest possible limits consistent with the accomplishment of that for which an army exists, *i. e.*, to conquer the enemy—such reduction in disease seems to be approximated in our army today.

The following table (page 201) epitomizes the nosological history of the entire army for the calendar year 1916:

On June 30, 1917, the Medical Department of the regular establishment totaled 23,199 persons, commissioned and enlisted, of whom 3,636 were officers of the M. R. C. on active duty. Of the National Guard on August 3 there were 1,848 officers of the Medical Department, of whom 1,407 were medical officers. At the date of promulgation of his report the Surgeon General remarks, as previously stated, "that at this time there are more than 13,900 officers engaged in the work of the department." Nor is this all, for General Gorgas expresses the opinion "that at least 24,000 physicians will be included in the personnel of the Medical Department of the Army when full strength is attained"—five times as many as were in all branches of the entire Regular Army at the beginning of the war. Even yet the story is not told, for the enlisted strength of the Medical Department, to correspond to this number of officers, will be over one hundred thousand sanitary troops.

It is of vast importance that this fact should be deeply impressed upon the minds of our countrymen.

What the training of such a force involves can only be appreciated when it is understood that these officers and men must be trained equally intensively with those of other branches of the Army. The medical officer and the sanitary soldier are a military part of a military body, with special function. There are certain prerequisites to officership in this body, its officers must be physicians to start with; just the

ADMISSIONS TO SICK REPORT, DISCHARGES, DEATHS, AND NON-EFFECTIVENESS WITH RATIOS PER 1,000 OF MEAN STRENGTH, FOR THE ARMY, CALENDAR YEAR 1916

International classification		Army (entire), officers and enlisted men (including Porto Rican troops and Philippine Scouts).							
	Mean strength	S. G. O., 110454—A. G. O., 110875.							
	Causes of admission to sick report	Admissions		Discharges		Deaths		Noneffective	
		Number	Ratio	Number	Ratio	Number	Ratio	Number	Ratio
	DISEASES AND INJURIES GROUPED								
	General diseases	24,000	217.28	495	4.68	122	1.10	1,151.76	10.39
1–19	Epidemic diseases	10,670	95.59	16	.15	31	.28	296.50	2.67
20–59	Other general diseases	13,330	120.68	479	4.53	91	.82	855.27	7.71
	Diseases of the nervous system and organs of special sense	3,572	32.34	483	4.57	24	.22	240.99	2.17
60–74	Of the nervous system	1,625	14.71	422	3.99	24	.22	168.61	1.52
75	Of the eye and its annexa	1,217	11.02	34	.32	.....	.....	43.73	.39
76	Of the ear and its annexa	730	6.61	27	.26	.....	.....	28.65	.26
77–85	Diseases of the circulatory system	2,393	21.66	86	.81	31	.28	131.17	1.18
86–98	Diseases of the respiratory system	6,301	57.04	42	.40	50	.45	158.00	1.42
99–118	Diseases of the digestive system	18,948	171.55	84	.79	45	.41	415.24	3.74
119–127	Diseases of the genito-urinary system	1,269	11.49	60	.57	21	.19	66.41	.60
142–145	Diseases of the skin and cellular tissue	6,080	55.05	12	.11	2	.02	158.14	1.43
146–149	Diseases of the organs of locomotion	2,869	25.97	211	2.00	.....	.....	149.97	1.35
150	Malformations, etc	365	3.30	3	.03	.....	.....	12.14	.11
154	Diseases, results of old age	3	.03	.....	.....	.....	.....	.18	.00
189	Ill-defined diseases	919	8.32	1	.01	5	.05	24.93	.22
	Total for disease	66,719	604.04	1,477	13.97	300	2.71	2,508.92	22.63
155–186	External causes	13,520	112.40	212	2.01	275	2.48	483.13	4.36
	Total for disease and external causes	80,239	726.45	1,689	15.98	575	5.19	2,992.05	26.99

same as in the Engineer Corps, its officers must be engineers, but that is only to start with. After that they must be taught to be soldiers, so that among other things they may teach the thousands of enlisted sanitary personnel, who have no preliminary qualifications, to be soldiers. It takes no less skill and time, indeed more, to make an efficient sanitary soldier than to make a line soldier, and all this is the task the less than 500 permanent medical officers had thrust upon them.

"Stop, Look and Listen," ye people! In an army of like numbers of fighting troops, which was the strength of our whole army when this war began, the law provided eight major generals and seventeen brigadier generals of the line, not to mention two major generals and nine brigadier generals of the staff, not because they are ornaments, but because they are deemed necessary. If such were really necessary in the one case, they are equally so in the other. The American people demand of their soldiers efficiency, for nothing inefficient is worth having. They do not now know that an efficient sanitary force is essential. They do not now appreciate that such a force, to be efficient, must be thoroughly trained as soldiers. Presently they will know these facts, possibly through a costly lesson; then, being just as well as generous, they will say that, to promote the efficiency of the service, the rewards to the sanitary forces shall be made coequal with those of the other branches. Such is not now the case. It has been asked: Will rank make us better doctors? No. But why, then, will it make better engineers?

The scheme of intensive education carried on by the Medical Department in the field has been fruitful in results. It was begun during the mobilization, and the details of it are set forth in the Surgeon-General's report. THE MILITARY SURGEON feels that it has a direct part in this, as the plan was largely due to Col. E. L. Munson, the editor. This plan was developed and adapted to the curriculum of the medical officers' training camps which have been so successfully conducted since the declaration of war.

Too much stress cannot be laid on the education of the sanitary personnel, even in the smallest details. Of course most of us are not to the military manner born, but we can acquire the "manner" by reasonable effort. In making this we should realize that the aggregation of innumerable small things makes great things, and each element is a factor in the result, be it good or bad. Even the manner of saluting is an excellent index of the training and discipline of the soldier, officer or man.

We might go on indefinitely reviewing this invaluable report, and then not come anywhere near doing it justice. This requires that it be carefully read and studied. To this end we heartily repeat our recommendation that a copy of the Surgeon-General's Report, 1917,

be sent to every medical officer and that it be made a text-book in our camps of instruction.

In closing this inadequate review, The Association of Military Surgeons, U. S., we are sure, would thank the Surgeon General for his kindly notice of its journal. The ambition of THE MILITARY SURGEON is to help in the herculean task our country has undertaken, by bringing before the membership the best current thought in military medicine, and commenting upon it, sometimes critically perhaps, but never in the spirit of destructive criticism.

THE MEDICAL DEPARTMENT OF THE NATIONAL GUARD

The annual report of the Chief of the Militia Bureau opens with an interesting résumé of the history of the movement, really begun in the last decade of the last century through voluntary coöperation, which has finally resulted in making the state forces a dependable part of the National Army. We refer the reader to the report for details of this and other interesting matter set forth therein, and turn to that which most concerns us, the chapter on sanitary troops.

The report notes the fact that, during the year, 21 field hospitals and ambulance companies and 93 detachments were organized, which, together with those previously organized, made a grand total of 59 field hospitals, 47 ambulance companies and 267 detachments, drafted into Federal service. This leaves a deficit of 5 field hospitals, 17 ambulance companies, and 22 detachments to be made up from the selected troops. The 5th, 6th and 7th Divisions from the northeastern section, the 12th Division from Illinois, and the 17th Division from Kentucky and Indiana were the only ones of the twenty divisions which had a complete sanitary organization.

One thousand four hundred and seven medical officers, three hundred and seven dental officers, and eighty-one veterinary officers, in all 1,848, were recognized by the bureau as eligible for transfer to Federal services, of whom about half have had previous service, a deficiency of 60 officers. The administrative and reserve officers were not drafted, not being included in the President's call. There were approximately 19,000 sanitary troops, exclusive of officers.

The prescribed theoretical course of instruction was carried out in the armories, as well as could be, under the peculiar circumstances of the year—257 medical officers and 762 enlisted sanitary troops, not on duty on the border, were called into Federal service in June and assigned to duty for instruction at the three Medical Department training camps, as was a field hospital and an ambulance company to each of the camps.

The report shows an interesting contrast between the number of all arms of the service, rejected on account of physical deficiencies in the mobilization for border service, 18.45 per cent, and that a year later, for war, 9.9 per cent, a clear indication that the medical officers of the National Guard knew at least 50 per cent more as to the physical standards for enlistment in the army than they did before mobilization. It is to be regretted that they did not make it 100 per cent. Yet this was hardly to be expected with a fourth of them without previous military service.

The report states that 65 sanitary formations "were supposed to be fully equipped and had animal-drawn transportation." These certainly were a valuable asset and must have been a great help in meeting the early exigencies of mobilization. Forty-one formations were, as previously stated, organized at the time of the draft and were not immediately equipped.

The matter of equipment, clothing, etc., is always a subject for discussion at this period of a war, in countries which regard war as they do famine or pestilence—something to be provided against when it comes. Nor do the people seem to understand why there is a dearth of these things when "a million men spring to arms over night." The departments can and do, in reasonable time, accumulate just as much equipment as Congress authorizes and provides the money for, and no more. Unfortunately, clothing, blankets, rifles, ammunition, barracks, and the endless number of things an army requires, do not spring into existence with the same celerity that "men spring to arms." These things require more time than "over night." Congress failed to make provision for them in time, consequently they were not provided and ready, in abundance, at the beginning of the war.

If the people have fault to find because our Army was not equipped "over night," let us blame ourselves for not providing against the contingency of war, an ever-present contingency.

In the meantime we have taken off our coats and are working, men and women alike, to remedy our lack of foresight, and are gradually doing it. Our Army is being equipped and trained and transported and soon will be doing what it was raised for—driving the Hun back to Berlin.

Following the example of the stage manager who requested the audience not to shoot the actor, "as he is doing his best," don't let us throw bricks at the War Department, which is doing its best—and a very good best—with a huge job our lack of foresight has thrust upon it.

The National Guard has already proved a valuable asset to the country and, continuing such, will leave its mark deeply graven, when the history of its share in this war comes to be written.

REPORT OF THE SURGEON GENERAL, U. S. NAVY, FOR FISCAL YEAR 1917

This report is particularly interesting, covering as it does a period of active preparation and rapid expansion of the Medical Corps of the Navy—in personnel, hospital and ship construction and equipment. The first few pages are devoted to the personnel of the corps and the efforts made to increase it as rapidly as possible. A very energetic publicity campaign is described to secure more material from civil life to reënforce the Medical Corps.

The remarks on the necessity of some knowledge of service conditions and methods, to make, out of a civilian practitioner, an efficient medical officer, are very timely and well put, and apply to all branches of the service. The response to the appeals of the Surgeon General of the Navy, by civilian physicians, for active duty in the Naval Medical Reserve Corps, has apparently been very gratifying.

Then follow a few paragraphs on the Red Cross activities as auxiliaries to the naval medical equipment—five Navy Base Hospital Units manned and equipped by the Red Cross, and their location, are noted as well as the smaller units for duty with new temporary hospital construction at Naval hospitals and stations—120 additional commissions in the Naval Medical Reserve Corps have been issued for the surgeons attached to these units. A great deal of valuable work for the Navy hospitals is being done by women—under Red Cross direction—in the making of surgical dressings, the Navy supplying the material, the women giving their time and services without remuneration. Very valuable material is in this way supplied and much time saved to the men of the Hospital Corps.

The report then takes up the subject of activities connected with war service and emergency hospital construction—giving in some detail the rapidly constructed additions to existing Naval hospitals. An aggregate of 10,000 beds is contemplated and the work is progressing satisfactorily. This does not include the hospitals at the large training stations.

Then follows a brief discussion of the contagious diseases—inseparable from mobilization—a serious matter demanding constant vigilance, skill and experience in sanitation, to be properly handled. The question of segregation of recruits in detention camps for three weeks is discussed. It is considered absolutely necessary to establish and maintain such camps, to avoid the wide spread of contagious diseases in the training camps. The methods recommended for the management of these detention camps are discussed in some detail. The necessity of well-equipped laboratories in each training camp is very properly insisted upon.

The connection of the Medical Corps of the Navy with the General Medical Board of the Council of National Defense is discussed. The question of standardization of medical and surgical equipment and supplies—a very important matter—is also taken up.

Several pages of the report are devoted to the expansion and training of the Hospital Corps—suddenly increased from 1,585, all ratings, to 6,000—the enlargement of the already existing, and the establishment of new, training schools. The course has been unavoidably shortened from six to three months, but the work is being done very energetically and successfully. The same is true in a lesser degree of the Nurse Corps.

Then follow some notes on the estimates and appropriations for the Medical Corps of the Navy, and on Medical Supply Depots. Pages 31 to 52 are devoted to the work of the Division of Sanitation, Sanitary Conditions and Measures Afloat—Hospital and Ambulance Ships—Sanitary Conditions Ashore in stations at home and beyond the seas.

There is a brief but interesting report on recruiting, with percentage of, and causes for rejection. This is followed by a very complete and well tabulated report of the health of the Navy, with a detailed statement of all diseases and injuries reported in the calendar year, 1916.

Altogether, in view of the rapid expansion of the Navy, the sudden change from peace to war conditions, this report is particularly interesting and instructive.

Wm. H. Arthur.

THE ANNUAL REPORT OF THE SURGEON GENERAL OF THE PUBLIC HEALTH SERVICE OF UNITED STATES FOR THE FISCAL YEAR 1917

The forty-sixth annual report of the Surgeon General of the Public Health Service, dated Washington, D. C., 1917, appearing before us in book form and covering in all 357 pages, is a simple, straightforward story, tersely-told, of duties faithfully performed, of work well done.

We are told that "the administrative organization of the bureau has been the same as heretofore." From this we must infer that the organization, resisting, as it has done in all these years, the inroads of changed conditions, must, from its very beginnings, have possessed the elements necessary for an enduring life.

The seven divisions through which the bureau conducts its work are the following: (1) Scientific Research, pp. 15-17=57; (2) Foreign and Insular (Maritime) Quarantine and Immigration, pp. 72-187=116; (3) Domestic (Interstate) Quarantine, pp. 182-253=172; (4) Sanitary

Reports and Statistics, pp. 254-308=55; (5) Marine Hospitals and Relief, pp. 309-316=18; (6) Personnel and Accounts, pp. 317-32=37; and (7) Miscellaneous, pp. 324-328=5. The remaining space is covered by statistical tables, a sketch of the "*Needs of the Service*," and the Index.

The number of pages devoted to the respective divisions may or may not indicate the relative importance attached to each one by the bureau.

On reading the different paragraphs appearing under the heading: "*Scientific Research*," some of us, having lived long enough to watch and observe, with the greatest interest, the origin and growth of the hygienic laboratory, from small beginnings to its present size and world-wide influence and scientific reputation, might perhaps be led to form the mistaken impression that the laboratory had been relegated to a position of less importance than it occupied in former years. The significant fact, however, is becoming more and more apparent, as time goes on, that the term "research work" can no longer be exclusively applied to work turned out by laboratories. Field work, as performed by the officers of the service, is research work and its unsolved problems are, today, as varied and as wide as are the vast areas of our country. Such work, even regardless of its important special practical value to the country and its people, signifies a very natural and necessary extension of the scope of the laboratory—a quite normal but progressive evolution of its ever varying functions! The field, in public health work is the place where the results of the training of investigators in scientific methods, in accuracy and thoroughness of observation, obtained and acquired in the school of the laboratory, must be tested as to their value, checked as to their reliability, in the numerous and varied attempts at the solution of the more practical health problems presented. Strategic planning and tactical performance are as necessary for success here as elsewhere. Coöperation here, as elsewhere, is the soul of efficiency. These things seem to have been recognized by the head of the service.

Consequently, after war had been declared and it had become necessary for a large portion of the personnel of the service officers, specialists in the various branches, to be transferred to survey work and other important war duties, the Government did not find the service unprepared to meet the extra exigencies placed upon it by war conditions; it was, on the contrary, found that the very work in which many of the officers had been engaged for years preceding the outbreak of the war—viz., in malaria, typhoid fever, rural sanitation, public health organization and administration and pollution of streams—amounted for them to a very desirable preliminary preparation and was of the most direct value in the making of such surveys of cantonments as it had become imperative to make at the outbreak of the war.

Field and laboratory investigations are discussed, in the report, under the following headings: (1) Surveys of the sanitary conditions and needs of extra cantonment areas; (2) diseases of man, including cerebrospinal meningitis, diphtheria, malaria, pellagra, poliomyelitis, scarlet fever, trachoma and typhoid fever; (3) occupational diseases and industrial hygiene, including health insurance; (4) public health organization and administration; (5) school hygiene; (6) rural sanitation; (7) pollution of streams; (8) pollution of coastal waters; (9) industrial wastes; (10) sewage disposal, and (11) viruses, serums, toxins and analogous products.

There is one disease, among the many, mentioned in the report, the story of which appeals especially to the reviewer, and perhaps also to the the reader of these lines, namely, "*trachoma.*" This disease, though present in other states, is most prevalent in some of the southern states, notably Tennessee, Kentucky and Arizona. It appears that the Public Health Service has been at work trying to eradicate this disease for the past three years and has, among other things, established six hospitals for this purpose. "The total attendance at those hospitals during the year was 18,430, and the total number of individual treatments was 127,914. One-half of the trachoma cases applying at the hospitals for treatment were found to have defective vision as a result of this disease. This impairment of vision ranged from comparatively slight defects to total blindness." With regard to the "*effects* of trachoma," the report says: "While blindness often results from trachoma, it is now recognized that this is only one, and possibly not the worst, feature of the disease. We know that it lasts for years with constant irritation and discomfort to the patient, impairing his earning capacity . . . ruining life and happiness of entire families, and finally terminating in total blindness. After nearly a lifetime of misery, the patient is often dwarfed in mind and warped in body with trichiasis, entropion and other sequelae still remaining to harass and irritate the sightless eyes." With reference to the relation of the disease to war, the report states that "it has been reported that an epidemic of trachoma is causing considerable anxiety in France, the disease having been brought to that country by African soldiers and laborers" and points out the necessity for an examination of the eyelids of all recruits and applicants for the service, coming from districts infected with the trouble. This precaution is said to be particularly applicable to some of the southwestern states, where the disease is known to be endemic and where it is likely that trachomatous persons will congregate in the vicinity of military cantonments. This is the pathetic story of a disease, comparatively little known on the part of the profession at large!

A notion of the extent to which "*Maritime Quarantine*" engages the Public Health Service may be formed on reading the following figures: "At the various national quarantine stations on the mainland of the United States, there were inspected 12,431 vessels and 709,770 passengers and crew. At the foreign and insular ports, service officers inspected 5,834 vessels and supervised the fumigation of 1,897 vessels . . . The grand total of passengers and crew inspected was 1,348,847 and vessels fumigated 4,693." Incidentally the results of fumigation directed against rats turned out to be in favor of the efficiency under certain conditions of cyanide gas rather than sulphur dioxide and since the promulgation of "*Safeguards to be Observed in Performing Fumigation with Hydrocyanic Gas*," by Surgeon General Blue, no accidents attributable to cyanide fumigation were reported up to the end of the year, although, approximately, 900 ships had been so treated!

The very excellent account given in the report, under "*Domestic (interstate) Quarantine*," of the measures for the control of the interstate spread of poliomyelitis at New York City, taken by the service, makes rather impressive reading not only for those unacquainted with the systematized efforts which it is usually necessary to make for the suppression of communicable diseases during epidemics, but also for the general health officer outside the service. This particular epidemic required the adoption of such radical and unusual methods for the enforcement of quarantine measures, on account of the fact that "from the very onset of the epidemic a feeling of apprehension, if not of actual alarm, prevailed throughout the country, even in communities altogether remote from the centers of infection. The work accomplished shows the great value of trained health officers of the service as well as the great importance of a responsive coöperation of local health officers of experience. Under the system adopted, travelers were no longer subjected to unnecessary inconvenience, amounting sometimes to positive hardship, but were protected from it.

"Through the division of '*Sanitary Reports and Statistics*' the public health service keeps itself informed of the occurrence of outbreaks and epidemics and of the prevalence and geographic distribution of preventable diseases, makes disease maps, keeps cognizant of current sanitary legislation through the collection and compilation of state and municipal laws and regulations and court decisions on matters relating to public health, and publishes weekly the Public Health Reports." The report is full of information, not ordinarily found in current medical literature, and should be widely read.

A government service that can look back upon a life of uninterrupted usefulness of one hundred and nineteen years; that has passed

through the storms and stresses of all these years unscathed; that has stood the test of time and of the never-ceasing changes of conditions and of the demands placed upon it and grown stronger with every succeeding year, can only seek and find the natural causes for its survival, its *raison d'être*, in (1) the unquestioned and absolute necessity for its existence to the state, and (2) in the soundness of its organization, its remarkable adaptability under trying circumstances, and its liberal and judicious administration. Such a service ought, therefore, as a quite natural sequence, to have its expressed and ever-increasing "*Needs*" attended to by an equally liberal and indulgent government, inasmuch as these must arise, in an ever-increasing measure, in its further growth from year to year.

H. G. Beyer.

DESCRIPTION OF DETENTION CAMP ERECTED AT NAVAL TRAINING CAMP, SAN DIEGO, CALIFORNIA

1. The location chosen for this camp is situated on the eastern side of the exposition street formerly running through the Amusement Concession and called "The Isthmus." It is opposite and just above the Isolation Camp and 200 yards north of the Station Hospital.

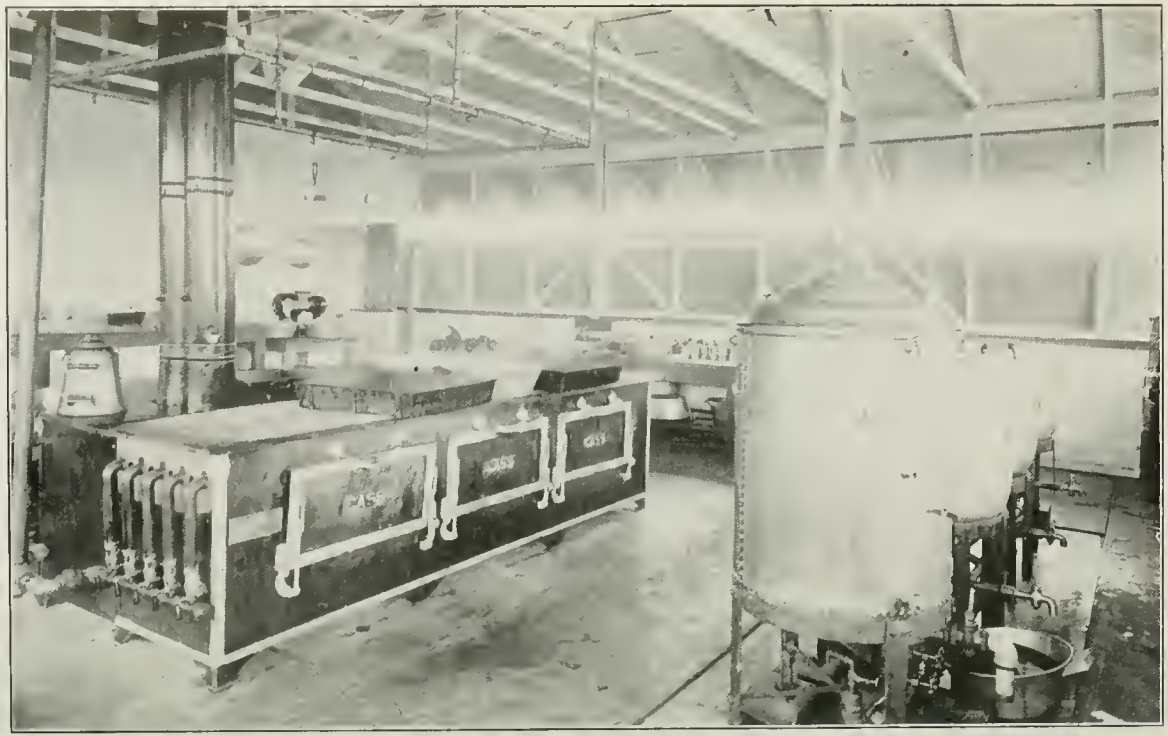
2. The general plan of this camp is as per appendix "A." Total length, 498 feet; total width, 230 feet. The camp is arranged in four sections, each section being equally subdivided into four smaller divisions or "paddocks," 110 feet by 56 feet, holding 12 tents, each accommodating three men. Thirty-six men are thus completely isolated and are to remain so during their entire 21 days' detention. Between each two of these paddocks is a house 14 feet 8 inches by 14 feet 5 inches, completely divided in the center line. The board partition fence comes to the center of this house. Within, and on each side, are placed a shower, a toilet, a washboard and water tap, and electric light. The floor is of cement. With the present installation twelve 9 feet by 9 feet tents are erected, two to each platform. This leaves an open area of ground 56 feet by 56 feet in which to drill and exercise. Four additional tents could be erected if necessary, giving an added capacity of 12 men—a total of 48. This, however, would not be advisable unless required by necessity. The present total capacity of this camp is 576, capable of expansion to 768. This expansion could not be accomplished if paddocks were occupied and could only be arranged in advance and before men were placed in detention. All tents are erected on wooden floors and side frames used to spread the canvas and fly. Woodwork, tent frames and the fences and houses are painted green.

Detention Camp—General View from Roof of Opposite Building Showing Arrangement of Paddocks.

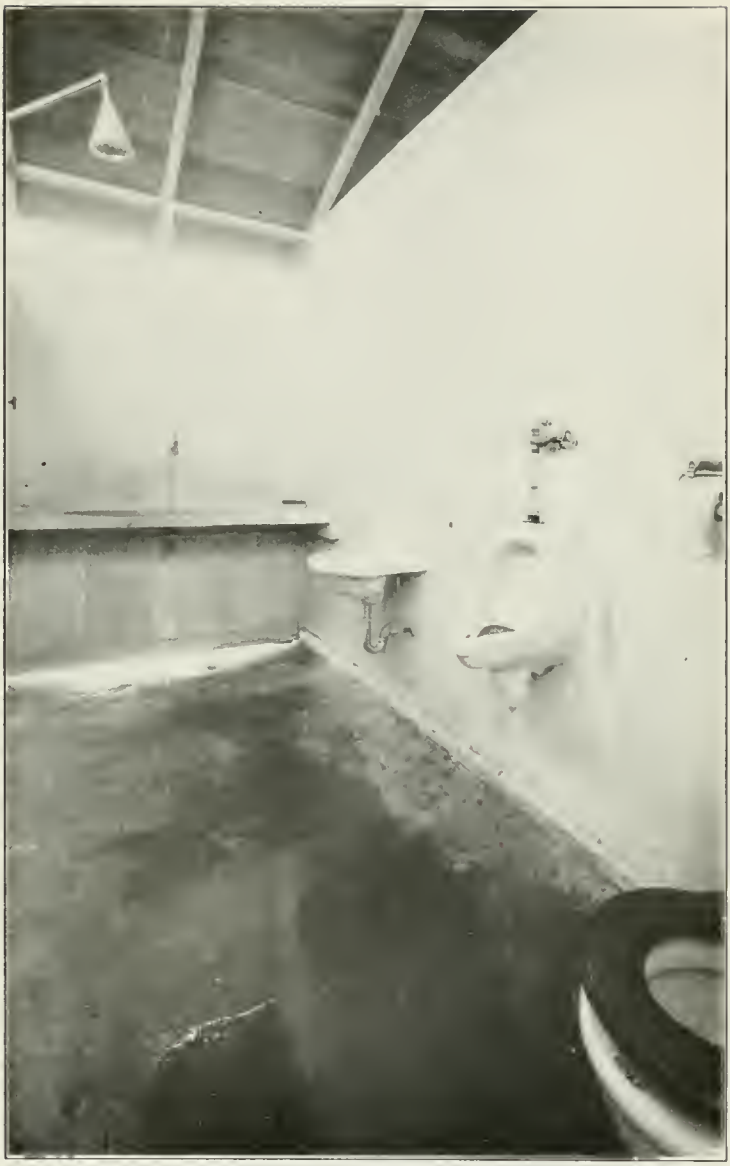
To face page 210.

Messing in Interior of Paddocks—Detention Camp.

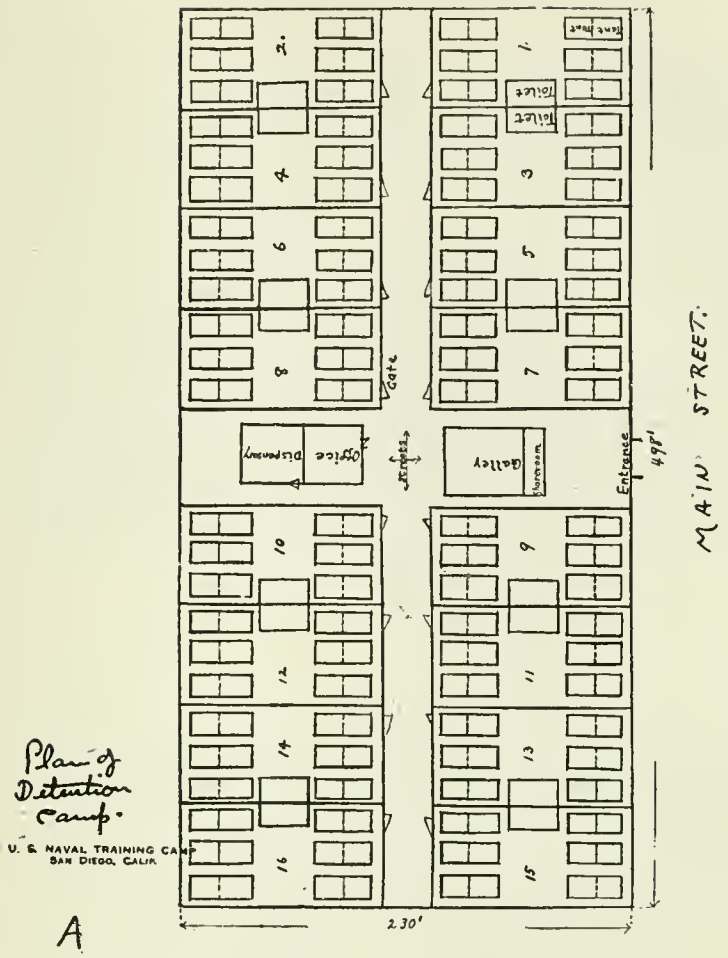
Transverse Street in Detention Camp.



Cook House—Detention Camp.



Toilet, Shower, Etc., Detention Camp.



as the bright sunlight here causes considerable discomfort if reflected from light colors. Paddocks are designated by numbers, 1 to 16.

3. The preparation of food for this camp is done in a cook house 40 feet by 30 feet, located in the center of the camp and at the end of the first section of the entrance street, which is 50 feet wide. It is complete in all respects. A storeroom, 10 feet by 30 feet, is made in its western quarter by a partition. The remainder is judiciously employed as a galley space with coppers, coffee urn, tables, etc. It is entirely screened, and sections of these screens raise up, window fashion; below these screens are wide window sills, or shelves, on which the food is placed to be taken by mess men outside for removal to the 16

paddocks. Ventilation, lighting and water supply are entirely satisfactory. Lighting, water connection and sewer connections are with city system.

4. Across the transverse street, and opposite the cook house, is a house 36 feet by 18 feet, made by placing together two small buildings, formerly used for exposition amusement purposes. The western half of this contains quarters for camp officers, office room, toilet, shower, basin and wash board. The eastern half contains a small and suitable dispensary.

5. The board fences between paddocks are 8 feet high. The inside wire fence is 6 feet high. The wire fence surrounding entire camp is 11 feet high. The camp streets and each tent are electrically lighted. Each paddock is entered by a gate.

6. The men are kept busy with examinations, instructions, police duties, squad, small arms, Swedish exercises, signal drills, etc. Night blinker and other signal drills are conducted by electrical displays on the office building mast, which can be seen by the entire camp. Internal police is performed by each uninfected paddock in daily turns, outside sentry duty by details from main battalion.

7. Attention is asked to the following advantages which it is considered this camp possesses:

(*a*) Complete isolation of units.

(*b*) Ability to expand both within paddocks (36 men to 48); and outside by the addition of entirely new compounds.

(*c*) Maximum of sunlight, drill and recreation space.

(*d*) Completeness of sanitary arrangements.

(*e*) Small cost of installation and maintenance.

(*f*) The camp is entirely self-supporting.

A. Farenholt,
Medical Inspector, U. S. Navy.

IMPROVISATIONS IN HOSPITALS[1]

In a perfectly equipped hospital, if there ever were such, there would be no improvisations, for everything of the best would be at hand to meet any contingency. And just in proportion as such is the case, by so much, is the hospital efficient.

But there are no perfect hospitals and, even in the best of them, improvisation must be resorted to occasionally. Nevertheless we must draw a line between improvisation, a thing of the moment, and substitution, by which is meant the providing of an equally effective but

[1] With six illustrations.

FIG. 1.—DRESSING CART

Note rocker arrangement of wheels, two at center and one at end. This allows the cart to turn corners easily. An 18-inch rule is fastened to the right leg of the cart, an inventory of load is hung to the left. Cost, exclusive of labor, $4.25.

FIG. 2.—DRESSING CART PASSING THROUGH NARROW DOORWAY

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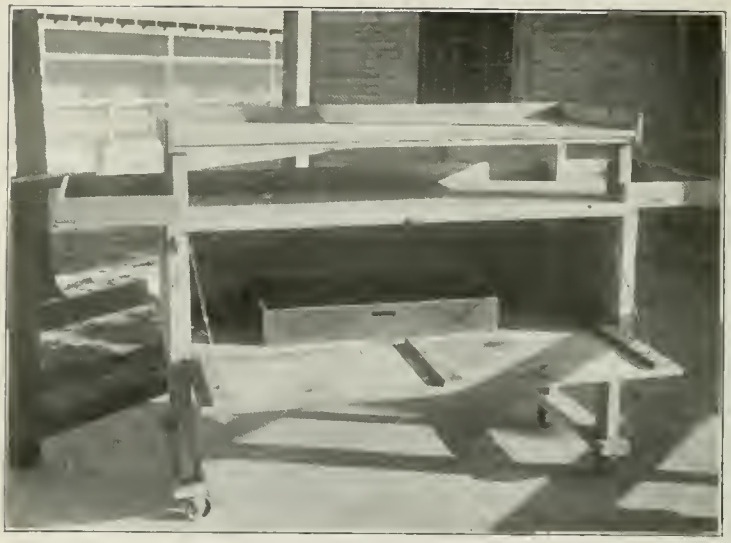

FIG. 3.—FOOD CART—THE LOWER PART USED FOR FOOD, THE UPPER SHELVES FOR DISHES

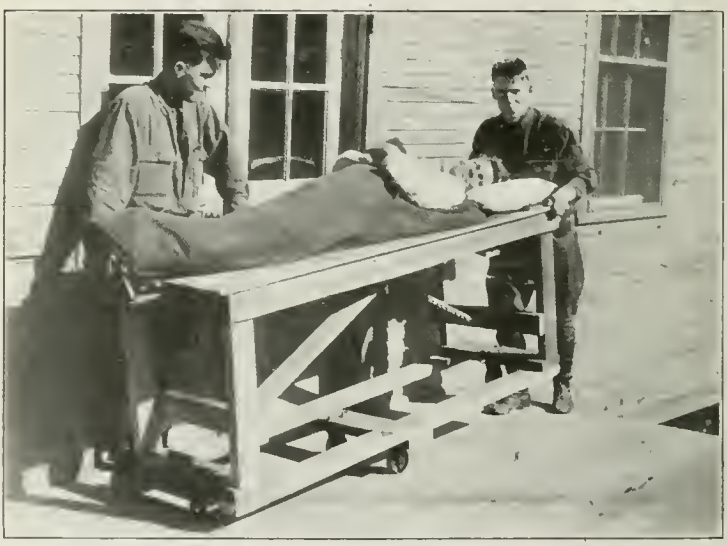

FIG. 4.—WHEELED STRETCHER

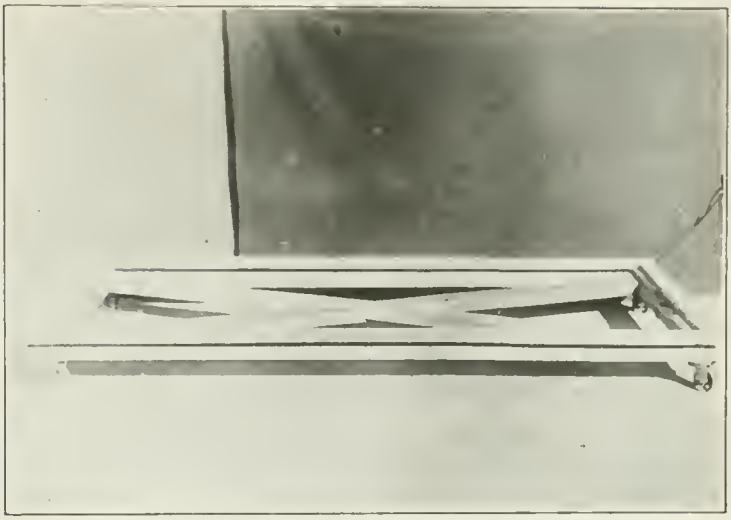

Fig. 5.—Bed Truck Folded

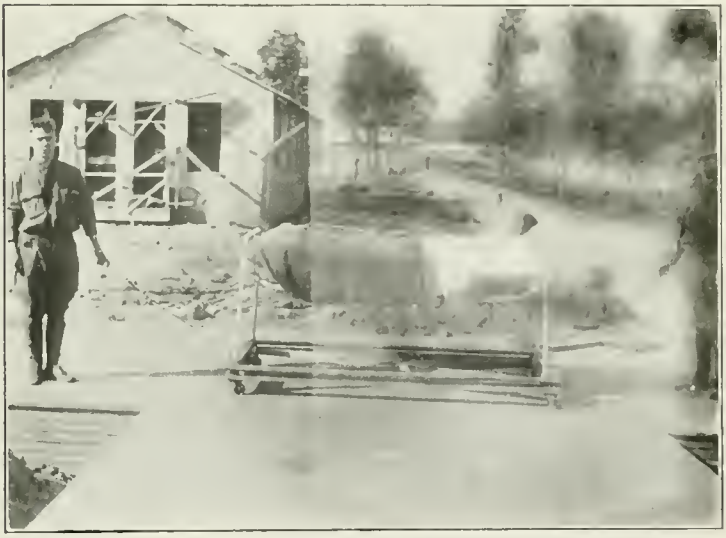

Fig. 6.—Bed Truck Loaded

inexpensive substitute, for a more elegant appliance, for permanent use about the hospital.

In military hospitals we should seek to approach as near as may be to the highest standards, but in the field it would be wholly impossible to attain unto the material accomplishments of, say, the Peter Bent Brigham Hospital, though with ingenuity we could devise substitutes which would give equally good results. He who has the most and best tools is not necessarily the best workman, but no man can do really good work unless he has an adequate supply.

It is certain that in our war hospitals we will have to provide substitutes for almost everything we have been accustomed to find ready at hand, or could send for to a neighboring store, and the really great medical officer is one who will have the vision to devise and provide these substitutes, against the time when they will be needed.

The Military Surgeon is fortunate in being able to present two memos in this issue, along somewhat similar lines, which would indicate that our medical officers are quite alive to the situation and will not permit themselves to fail in their work, or even to complain, because of lack of immediate access to a furniture store or instrument shop.—*The Editor.*

Major John C. A. Gerster, M. R. C., U. S. A., writes:

Vehicles for hospital use such as dressing carts, wheeled stretchers, bed trucks and food carts, if made of metal, cost between $75 and $125. Vehicles serving the same purposes can be improvised by constructing them of wood and fitting them with small iron wheels—four to the vehicle. The cost varies between $2.85 and $5.50, depending on the type of vehicle in question.

A dressing cart (Fig. 1), roughly estimated, costs $4.25 for material, exclusive of labor (in an army organization this cost is nil).

A food cart of the type shown in Fig. 3 costs $5.50 for materials, including lumber (110 square feet) and hardware (cast iron casters, 4; 5-inch strap hinges, 2 or 3; rope or chain, 4 to 5 feet; nails, 1 pound; 4-inch bolts, 16). This cart serves a double purpose. In the enclosed bottom section, the food containers are carried from the kitchen to the wards. In the diet kitchens of the latter the food containers are placed on small stoves and the food is then placed in individual dishes on the shelves of the food cart (which now constitutes a "tray cart"), which is then rolled into the ward for delivery of food at the bedside.

A wheeled stretcher (Fig. 4) costs not more than $3.75. It can serve as a wheeled carrier of the regular army litter by having holes countersunk for the four litter stirrups.

A bed truck (Figs. 5 and 6) costs $2.85. It is simply a wooden frame with swivel casters at the corners. It is the only type of vehicle in the list which requires swivel casters; the other types all do well enough if provided with the simple type of cast iron wheel shown in Figs. 1 and 4; these are placed as follows:

two at the center, blocked up a little, one at each end. This allows for a little "fore and aft" seesawing, and permits an easy turning of corners.

The vehicles were in use and the photographs made while the author was in charge of the surgical service of the base hospital, Camp McClellan, Alabama.

From a transportation point of view it will be seen that it is much simpler to send lumber and hardware to any given point and to have the construction on the spot than to send crated vehicles which would take up many times the space.

THE HART FOOD CART[1]

A hospital train food cart, on the same principle as that described by Major Gerster, but which can hardly be called an improvisation or even a substitute, is described by First Lieut. George B. Rietz, M. R. C., Commanding Hospital Train No. 1, in the following interesting note on its evolution:

The distribution of food to patients in hospital trains is a problem which, heretofore, has given occasion for much thought and concern to those in command of such units.

In the operation of Hospital Train Number One, on the Mexican Border in 1916, it was necessary to serve the food in the kitchen car (Fig. 1) and then carry it on trays to the patients or else carry the food into the car in bulk, in non-insulated vessels, from which it was served by the nurses.

Both methods were open to the objections that the food invariably reached the patients cold; due to the small amount of space available in a kitchen car, in which to serve, there was a cluttering of attendants in this car at meal time and the service could not proceed with that orderliness which is so essential in hospital train work; and due to the swaying and jerking of the train, more or less of the food was spilled over the utensils and to the floor of the car.

In an endeavor to meet and obviate these conditions in a satisfactory manner, a food cart, a description of which follows, was designed by Maj. W. L. Hart, Medical Corps. Two of these have been built by the Pullman Company for use on Hospital Train Number One, and it is confidently expected that they will fulfill all requirements. The cart is a combination of the tea-cart and fireless cooker, adapted to meet the special conditions.

The cart is $34\frac{3}{8}$ inches high, $45\frac{1}{4}$ inches long, 19 inches wide over all, and is constructed of birch, which has been stained mahogany. At one end of the lower frame-work are attached two 12-inch iron tire, hickory wheels with hickory hubs. The wheels have ball bearings. At the other lower end of the cart the framework rests on the floor. On the upper part of the framework, on the same side where the frame rests directly on the floor, are two projecting handles continuous with the upper framework. The top is covered with white metal and has two openings for the food containers. These containers

[1]With two illustrations.

THE HART FOOD CART.

To face page 214.

THE HART FOOD CART.

are made of copper and have a capacity of 5 gallons each. Each container has a removable cover. The receptacles in which these food-containers rest are constructed so as to prevent the loss of heat and also maintain the heat of its food contents. To do this it was necessary to construct these receptacles, which are cylindrical, so that they had two walls, $^1/_{16}$ inch apart, and a false bottom. In this space between the two walls pulverized asbestos has been packed and the bottom covered with sheet asbestos. The false bottom has a door which opens outward and is so constructed that a piece of iron measuring $7^7/_8$ inches by 10 inches and $\frac{1}{2}$ inch thick (which is the heating element) can be placed in the false bottom without any difficulty.

The iron disc would probably not be required for ordinary service of food, as the food would retain its own heat for that length of time, but the disc would be required if the carts were used as fireless cookers, especially at night, in the preparation of cereals, etc., for the next morning's meal. In this case the disc would be heated on the range before insertion.

To facilitate the lifting of the carts over end door threshholds and also while going through the vestibules of the cars, a metal handle was attached to the upper frame-work of the carts, opposite the projecting handles.

The carts, with containers empty, weigh 162 pounds each. When containers are full the added weight makes these carts quite heavy. This is an advantage rather than a disadvantage, for while the train is in motion, swaying or going over crossings, this weight gives stability to the carts, thereby preventing the spilling of food.

CURRENT LITERATURE

ON SPIROCHETOSES.—That the commingling of the different races of the world on the European continent, which has gone on during the last three years of the war, may not prove to be an unqualified blessing in after years for the nations of Europe, is daily becoming more and more apparent to the student of parasitology. The frequent discovery of new parasites of the order of spirochetes would make it appear inevitable that the present attempt at the introduction of democracy into Europe, with the aid of exotic germ carriers, must necessarily be accompanied by the simultaneous introduction there of a *parasito-cracy* in which the spirochetes will, some day, figure as the predominant disease-producing autocrats. It now seems not improbable that, long after all the possible war indemnities will have been paid off, long after all our cripples will have been restored to a life of usefulness or died, these newly introduced parasites will continue a war tax on human lives.

Thus, different varieties of spirochetes alone have been introduced into Europe through Russian troops from the Orient; through English troops from India and Egypt; through French troops from Indo-China and Tonkin; from Morocco and the Senegal; through Turkish troops from Arabia, Mesopotamia and Syria; through English troops from Australia, the South Sea Islands and Canada. Even new species of malaria-bearing mosquitos and the yellow fever germ-bearing stegomyia are threatening southern France, according to Blanchard.

An unusually rich collection of reports on different forms of spirochetoses having recently been published in *Annali di Medicina Navale e Coloniale* (Anno xxiii, Vol. i, Fasc. iii-iv, March-April, 1917), a few abstracts may prove interesting to our readers:

On Ictero-Hemorrhagic Spirochetoses, by Costa and Troisier. Comptes rendus des Séances de la Société de Biologie, December, 1916.

This contribution emphasizes three points: (1) The virulence of the cerebrospinal fluid in ictero-hemorrhagic spirochetosis, during the initial stages of the disease, in both new cases and relapses; (2) the frequent occurrence of positive reactions of syphilis; (3) the passage of the ictero-hemorrhagic virus from the general circulation into the ammotic fluids of the guinea-pig.

Clinical Study and Laboratory Notes on Ictero-Hemorrhagic Spirochetoses, by Wilmaers and Renaux. Archives medicales belges, February-March, 1917.

In this excellent monograph the clinical signs are described as follows: Onset sudden with general depression and headache lasting often during the first week of the disease; icterus, of varying intensity, coming on on the second to the fourth day; early albuminuria and bilinuria; the temperature quickly reaches 39–40° C., lasting three or four days with slight morning remissions, gradually going down to normal on the seventh to the ninth day; after a few days, fresh rises in temperature occur, sometimes, but less intense and regular, followed by anemia and a prolonged convalescence. These symptoms may be followed by complications; such as hemorrhages, epistaxes, depressions of nervous origin,

agitations, delirium, nephritis, congestion of the conjunctiva, herpes labialis, constipation, enlargements of liver and spleen. Alongside of such cases, light ones occur in which the prominent symptoms are in abeyance and in which the presence of spirochetes in blood and urine are the only means of identifying the disease.

Treatment.—Neither arsenobenzol nor quinine were found effectual. In the absence of a specific serum, the authors had recourse to treatment with the salicylates of soda and to the administration of adrenaline in cases of arterial depression.

Laboratory Notes.—Under this heading the authors give a detailed description of the microscopic appearances of the parasite which we regret being obliged to omit. Cultures of the germs have so far proved unsatisfactory; the parasites, however, could be kept alive for from four to five weeks by means of the method of Noguchi, with fragments of the kidney from a guinea-pig in pleuritic fluid, in human and guinea-pig blood serum. The disease was also reproduced in guinea-pigs through peritoneal injections of blood, taken from a patient during the fourth to fifth day of the disease. The extreme regularity with which the parasites appear in the urine is considered one of the most characteristic signs of the disease.

Phenomena of Immunity.—It is now admitted that, during the course of the disease in man, there appears in the blood serum, toward the fourth day, an antibody; this time coincides precisely with the appearance of the spirochetes in the urine. This antibody has been put in evidence in two ways: (1) When a guinea-pig, after having been inoculated with infectious liver pulp, receives an injection of serum from a convalescent, either the disease is arrested or, in case icterus had already made its appearance, a cure is effected. (2) If, after the injection into the peritoneal cavity of two guinea-pigs of 2 cc. of hepatic pulp, rich in spirochetes, one of these two receives an injection of convalescent serum, while the other receives normal serum, it is found that the spirochetes have disappeared from the peritoneal fluid of the former within half an hour, while in the latter the spirochetes are still abundant and mobile at the end of two hours. The hepatic antigen, moreover, reacts positively with syphilitic subjects.

The authors sum up their observations in the following conclusions: "(1) The ictero-hemorrhagic spiroehetoses observed in Belgian troops seem identical with the affection described by Japanese observers as occurring among the miners in some localities. (2) The causal agent, the spirocheta of Inado-Ido, is very pathogenic for guinea-pigs. (3) The sudden onset, the icterus, the hemorrhages, the febrile curve and the anemia are the cardinal clinical symptoms of the disease. (4) The renal and the hepatic lesions, being the most constant, find their corresponding expression in the albuminuria and bilinuria. (5) The appearance of spirochetes in the blood during the first six days of the disease demonstrated, by the inoculation of guinea-pigs, their presence in the urine from the fifteenth day, confirms the diagnosis. (6) The epidemiology is as yet unknown. (7) The mortality rate is low. (8) Light cases, in which one or more of the cardinal symptoms are wanting, must be diagnosed by a systematic examination of the urine."

Nosographic, Epidemiologic and Anatomic Notes on Infections, Spirochetic Icterus, by Monti.

After giving an accurate and detailed description of the clinical characteristics of the disease, the author gives us an account of some of his microscopic examination: "In the blood of guinea-pigs, in films from liver substance and spleen, from lymphatic glands, a particular spirochete may be demonstrated by means of Giemsa's method. The histological examination of the liver shows disseminated necrotic foci, punctiform hemorrhages; around such areas the spirochetes are abundant; others are found collected within the lumina of intralobular capillaries and the larger blood-vessels and even in the biliary ducts. Monti believes in the identity of hemorrhagic icterus, as found in troops, with that described by the Japanese; he believes it possible that the disease may be transmitted through the urine especially under the conditions of overcrowding prevailing in the trenches, and in spite of the fact that the parasites in question do not survive twenty-four hours in the cadaver.

Ictero-Albuminuric Spirochetoses and Recurrent Fevers, by Gabbí. *Riforma Medica,* 17 March, 1917.

"The symptom-complex observed in our soldiers at the front, when compared with that given by Japanese physicians and that of Weil, some thirty years ago, differs from them in that the symptoms are less complicated, the relapses rarer, the mortality lower, and in that it is sporadic rather than epidemic. The morphology of the spirochete described by the Japanese corresponds entirely with that given by the Germans and by some of our own authors. As for the sindromes and the morphology of the spirochete there is no such thing as identity between the forms observed in Japan and those met with among our troops. Instead of speaking of more than one indigenous form, we must assume imported forms." According to Monti, spirochetic infectious icterus has been *imported from the Orient,* passing from the Russians to the Germans and Austrians and, from them, to the French and Italian fronts. Since hemorrhages, in the cases observed in France and England, are often wanting, Monti proposes to call the disease "spirochetosis ictero-albuminurica."

Spirochetosis Ittero-emorragica, by Cesa Bianchi. Societa lombarda di scienze mediche e biologiche, February, 1917.

The spirochetic virus, contrary to the assertions of the Germans and the Japanese, does not pass through Chamberland's filters; it is attenuated by a temperature of 45°, rendered inactive by 55°; possesses but slight resistance to cold, to sunlight, to putrefaction, to osmotic pressure, to the air. On this account the author finds it difficult to believe in the transmission of the disease through water, contaminated food or direct contact; he deems it more probable that the disease is disseminated by one of the blood-sucking insects.

The Meningitis in Ictero-hemorrhagic Spirochetosis, by Costa and Troisier. *Presse Medicale,* n. 19, April, 1917.

Virulence of the Central Nervous System in Experimental Infection.—"The spirochete of hemorrhagic icterus has an affinity for the nervous system not less

strong than that of syphilis. The inoculation of experimentally infected cerebral substances has shown itself to be as virulent as the inoculation of blood, urine or hepatic parenchyma; often, even, it occurs that death supervenes more rapidly in animals inoculated with cerebral substance." In our authors' experience, meningitis is a common complication of ictero-hemorrhagic spirochetosis. The headache is localized in the frontal and occipital region. The rachialgia is accompanied by general muscular contractions of the trunk, rendering the patient as rigid "as a stick of wood." One of the first symptoms to make its appearance is rigidity of the nape of the neck; the symptom of Kernig is constantly present, whether the patient is sitting up or lying down.

Intellectual disturbances, though rare, are agitations and low delirium, the tendon reflexes are diminished or abolished; pupils sluggish; cutaneous reflexes exaggerated. Vomiting is constant at the onset; pulse is rapid and goes up with the temperature.

In the meningeal form of the disease, there is an intense leucocytosis; polinuclears predominate to the extent of 70 to 90 per cent; in the ordinary forms the polinuclears, mononuclears and lymphocytes are equal in numbers; whenever there occurs a lymphocytosis at the beginning, the prognosis is favorable. The chemical alterations consist in hyperalbuminosis; the chlorides are slightly increased in amount; sugar may be present; urea may supersede 4 grams.

The diagnosis is confirmed by the inoculation of infected urine into a guinea-pig, in which a characteristic disease is thus produced. Besides, the serum from a patient with spirochetosis fixes complement in the presence of syphilitic antigen, in the same manner that serum from a syphilitic patient fixes conplement in the presence of spirochetic antigen. Neutralization reactions of the virus may also be employed with advantage.

The course of the meningitis is always favorable and the issue depends rather upon the general state of the patient than on the meningeal complication. Arsenical preparations should never be given, in view of the serious nature of the existing renal and hepatic complications. Good results were noted with the antispirochetic serum of Martin and Petit, injected intraspinally.

Rats and Spirochetosis, by Courmont and Durand. *Bulletin medical*, n. 5, 1917.

Examining fifty sewer-rats, from the sewers of Lyons, the authors were able to provoke hemorrhagic icterus in 8 per dent of their cases; thence they conclude that the spirochetes are widespread and not confined to any particular locality.

Spirochetosis and Marmots, by Sawal. *Presse medical*, p. 1017.

In the blood of two marmots that had been inoculated with the blood from a patient on the third day of the disease, and which died during the period of pyrexia, specific spirochetes were found.

Ictero-Hemorrhagic Spirochetosis in France, by Martin and Petit. *La Presse medical et Journal des Praticiens*, December, 1916.

The authors believe that the treatment to be relied on is serotherapy; they had obtained a curative serum from the horse which is inoffensive for the normal

guinea-pig This serum, in small doses (1 to 2 cc.), neutralizes completely, *in vitro* as *in vivo*, a quantity of the virus, able to kill the control animals in a few days; one single injection, given on the third day of the disease, will prevent icterus and the death of the animal which had been given a dose of poison, usually killing it in six days.

Serotherapy in Weil's Disease, by Inada and Ido. *The Journal of Tropical Medicine and Hygiene,* January, 1917.

The authors employed an immune serum which they had obtained from horses. Out of thirty five patients that were treated with this serum, seven died. The usual mortality from Weil's disease in Japan, ranges from 30 to 48 per cent. In view of this reduced percentage mortality, the authors maintain that serotherapy has a considerable effect on the disease.

Immunizing Substances in Convalescents from Icterogenic Spirochetosis, by Carnier and Reilly. C. R. Soc.: Biologie, 1917.

Blood serum, obtained from convalescents after severe attacks, is richer in immune substances than serum from patients having passed through light attacks. Experimenting with guinea-pigs, these authors were able to demonstrate the highly protective value of the former against the disease virus, while the protective value of the latter was slight or altogether absent.

On the Etiology of Weil's Disease, by Weil. *Dent. med. Wochenschrift,* 1916.

The author observes that many writers, recently, have described, under the denomination of "Weil's Disease," a disease entirely different from that which bears his name, namely: an acute infectious disease with enlarged spleen, icterus, nephritis. According to the author, the spirochete of Huebener and Reiter has nothing in common with the disease described by him.

The preceding abstracts were made from an interesting collection appearing in the *Annali di Medicina Navale e Coloniale* of March-April, 1917, with apologies due to A. R. Gori. H. G. Beyer.

"Du Groupement en Colonies Agricoles des Soldats Paludéens, Momentanément Inaptes," by Dr. Jeanselme, Medecin-major de 1re classe. *Bulletin de l'Academie de Medicine,* Tome lxxviii, Seance 10, Juillit, 1917, p. 21.

Jeanselme expresses the opinion that a malarial infection, after passing the primary stage, is one of the most tenacious of infections, stating that, no matter what the medication, whether large doses of quinine or arsenic, whether introduced by the mouth or otherwise, the infection is merely rendered latent, rarely cured.

Malarial subjects, having apparently recovered after an energetic course of treatment, improved in color and in weight, will suffer from a relapse but a short time after the treatment is stopped. Every slight fatigue incurred will have the same result and thus prove the fictitious and precarious character of such a cure. One of the best tests to prove that the cure is merely apparent is to give one of these patients an intravenous injection of 250 cc. of normal physiological salt-solution; it will be followed by a classical malarial attack.

Instead of giving such patients leaves of absence, Jeanselme proposes to send them in groups on farms where their treatment is to be continued under proper supervision, and where they may do useful work under the best hygienic conditions, until a more enduring cure is effected!

H. G. Beyer.

War Cripple Axioms and Fundamentals.[1]

Each of the thirty-three paragraphs under the above heading, which we quote *in extenso* from Dr. McMurtrie, presents an axiom. They all should be engraved in golden letters on the hearts and minds of every one who undertakes to devote his time to, or indeed every one who will be in any way connected with, the present or future re-education of our war cripples; they should become the principles of action and permanent guides to experts, professionals and lay-assistants alike, for they are the results of actual experience, coupled with profound thought, fertile imagination and sound reasoning; the outcome of a single-minded life among cripples, of a man in the truest sense of the term, and of an observer and worker of no ordinary ability, circumspection and judgment. The lessons conveyed by a study of these paragraphs should be accepted as the foundation for the development and elaboration of any future plans of reconstruction, deserving to be considered sound and entitled to the claim of being well conceived.

H. G. Beyer.

Douglas C. McMurtrie, who has given years of study and observation to the subject, sums up the position and prospects of the disabled soldier and sailor from various viewpoints. Certain statements made by him are here quoted chiefly because *they are accepted as true by the majority of practical rehabilitation students.*

1. *The waste involved in the complete support in all countries of thousands of workmen injured* in more or less serious degree, became soon apparent, and the authorities cast about for some means to decrease the percentage of disability. The solution was found—notably in Belgium and France—in trade-schools for the re-education of the crippled victims of industrial accidents.

2. The first country to act in preparation for cripples of the present war was Germany, the national association in the interest of the deformed issuing a call to its members eight days after the outbreak of hostilities. The next move was in France, when Edouard Herriot, mayor of Lyons, undertook the organization in that city of a municipal training school for the *mutiles de la guerre.* In England the Incorporated Soldiers and Sailors Help Society—organized after the South African war to maintain workshops for disabled veterans—largely extended its activity. In Canada a federal commission began at once the establishment of convalescent homes and training classes. Italy and Russia likewise took thought for their cripples during the early months of the war.

3. The wounded soldier comes through the field and base hospital and, finally, if his disability is such as to disqualify him from further military service, he is returned from overseas to a convalescent hospital at home. Certainly, *at this point, if not perhaps earlier, preparation for his social and economic rehabilitation should begin.*

[1] From Bulletin No. 1. Surgeon General's Office, U. S. Army. Division of Reconstruction and Re-education. January 19, 1918.

4. *The new handicap usually throws the man into a state of extreme discouragement.* The loss of a hand, an arm, or a leg seems, to the man formerly able-bodied, an insuperable obstacle to his future economic activity. The prospective pension is the only mitigating feature of this depressing outlook, and he begins to calculate how he can exist on the meager stipend which will become his due. He has basis for this expectation, for has he not known in the past several men each of whom had lost a limb through accident? It was necessary for them to eke out a living by selling pencils on the street. Again, life will hold no pleasure in the future· he will always feel sensitive about his missing limb. Besides, nobody has any use for a cripple.

5. Such a state of mind will be encountered in the convalescent soldier. *It must be met and overcome.* With returning health, initiative must be reawakened, responsibilities quickened, a heartened ambition must replace discouragement. We can go to him and truthfully say: "If you will yourself help to the best of your ability, we will so train you that your handicap will not prove a serious disadvantage; we will prepare you for a job at which you can earn as much as in your previous position. Meantime, your family will be supported and maintained. You will be provided with a modern artificial limb so that a stranger would not know you are crippled. Finally, we will place you in a desirable job."

6. The first reaction to this program is *fear that an increase of earning power will entail a reduction of pension.* When re-education of war-cripples was first begun in both France and Germany, it was found that many of the men were unwilling to undertake training, in apprehension of prejudicing their pension award. The solution of the difficulty was official announcement that such would not be the case, but that pensions would be based on degree of physical disability alone, without reference to earning power. In Canada, a placard to this effect is posted in all military hospitals and convalescent homes.

7. The choice of trades, in which war-cripples may wisely be trained, is of primary importance. In addition to considering whether men with certain types of physical disability can engage in a given trade, its present and prospective employment possibilities must be taken into account. If it is a seasonable trade, if the number of workers needed in any locality is so small as to make difficult the absorption of many newly trained men, or if the industry is on the wane rather than enjoying a healthy growth, the indications are negative. The ideal trade is one in which the wage standards are high, the employment steady, and the demand for labor constantly increasing. In picking trades, the present boom conditions should be discounted.

8. The trades actually being taught to war cripples are many and varied. In France at the notable Ecole Joffre at Lyons there is instruction in accounting and commercial subjects, toymaking, bookbinding, shoemaking, woodwork, mechanical, drafting, tailoring, woodcarving, gardening, and machine tool work. At the suburban branch at Tourville, agricultural courses are given. In Paris at the "Institute National Professionel des Invalides de la Guerre" are taught the standard trades of tailor, shoemaker, harnessmaker, and tinsmith. Also, dependent upon the ability of the individual pupil, instruction is provided in accounting, industrial design, cabinet-making, and automobile engineering—particularly the operation and repair of agricultural tractors.

In Rome, the Italian war cripples are being taught commercial subjects, carpentry and wood-carving, bookbinding, boxmaking, saddlery, and leatherwork, shoemaking, tailoring and blacksmithing. At Naples there is instruction in shoemaking, tailoring, telegraphy and commercial subjects.

The school in connection with the Maximilian Hospital at Petrograd offers a

considerable range of courses, among them the following: manufacture of orthopedic apparatus, locksmithing, shoemaking, cabinet-making and tailoring.

At Nurnberg, Germany, the crippled soldier learns to become a blacksmith, locksmith, maker of orthopedic apparatus, machinist, cobbler, tailor, cabinet-maker, saddler, upholsterer, weaver, paint-brush maker (a strong local industry), printer or bookbinder. There is also instruction in industrial design as applied in varied fields. At the Dusseldorf school, instruction is given in machine-tool work, mechanical drafting, building trades, telegraphy, and commercial and civil service subjects.

In England, the workshops of the Incorporated Soldiers and Sailors Help Society provide training in the following trades: carpentry and cabinet-making, printing, polishing, carving and gilding, picture framing, toymaking, basket-making, metal work, building and construction, decorating and electrical fitting. The principal subjects at Roehampton and Brighton (Queen Mary's Convalescent Auxiliary Hospitals) are inside electrical wiring, motor driving and repairs, and woodworking, which includes bench and lathe practice. At Cliveden and at other points in Britain, agricultural training is available.

In the Canadian schools, under the auspices of the Military Hospitals Commission, the leading trades are motor mechanics, machine tool work, carpentry and wood turning, inside electrical wiring, telegraphy, cobbling, operation of agricultural tractors, general farming and poultry raising. Instruction is also provided in bookkeeping, general office-work, and civil service subjects.

9. The section of the country in which a man lives also has a bearing on the choice of a trade in which he is to receive instruction. Thus a Canadian, living in Montreal, may be trained as a machinist: the same man, if a resident of a far western province, would better be given instruction in the operation of motor tractors for agricultural work.

It is axiomatic that a man should be given his course of training in a locality near home. Here he will not feel so strange, friends will not be far away, and the educational authorities will be in closer touch with the local industrial requirements and employment conditions.

10. It is the general consensus of experience that the decision by the man to undertake a course of training must be a voluntary one. Of course, he might be retained in the military organization and detailed to trade classes in the same way as he is detailed to guard duty, but this would not make for successful results. The unwilling and rebellious pupil learns but little, the earnest and ambitious one makes rapid progress. The man must be persuaded, therefore, to take up instruction; the future advantages of being a trained workman in some skilled trade should be pointed out, and the practical arrangements to be made for him during the course of instruction carefully explained. There is no royal road to success in this effort, but after gaining the soldier's friendship and confidence, a patient persistence will win the battle. If a competent visitor has been in touch with the man's family during his absence at the front, the members of the home circle can be easily convinced of the wisdom of his re-education; this will make all the simpler persuasion of the man himself.

11. A difficulty is found in the abnormal premium on industrial labor in war time. Even a disabled man may be able to go out and earn seven dollars a day in a munition factory. This constitutes a very potent present counter-attraction to representations of moderate but permanent employment, after a course of training. If he makes the opportunist choice he will, upon the return of employment conditions to normal, be reduced to the status of a casual laborer, perilously near the verge of mendicancy. No pains should be spared to prevent this eventuality.

12. In deciding which of the available courses an individual disabled soldier should pursue, the first effort should be to fit him for an occupation related as closely as possible to his former job. His past experience—far from being discarded—should be built upon. A competent journeyman bricklayer who has lost an arm may be prepared, by a suitable course in architectural drafting and the interpretation of plans, to take a position as construction foreman of a bricklaying gang. It were idle to give such a man a course in telegraphy. But a train hand who has been all his life familiar with railroad work may most wisely be trained as a telegraphic operator, with a little commercial instruction on the side.

13. This rule applies, however, only to men who were, previous to their enlistment, operatives in the skilled trades. Their problems are the simplest of solution. But in the present war, when not only professional soldiers but whole nations are in arms, there will return disabled many young men who had not yet attained a permanent industrial status. Some will have entered the army direct from high school or college; others will have been migratory workers who had not yet found a permanent niche and whose experience has been too varied to be of much value; still others will have been drawn from unskilled and ill-paid occupations which hold little future opportunity for the able-bodied worker, and almost none for the physically handicapped.

14. Advice in each case should be given by an expert vocational counsellor, a man familiar at once with trade education, with the requirements of the various industries themselves, and with the current status of the labor market. His opinion should take into account the report and prognosis of the medical officer, and also the past record of the individual. As has been pointed out, the friendship and confidence of the soldier are absolutely essential. Very often they are difficult of attainment and the prospective pupil's reserve is penetrated only in the fourth or fifth visit. As the decision to undertake training at all must be voluntary, so must the choice of particular trade meet with the full approval of the soldier himself. And if, after beginning the course, the subject proves definitely distasteful, the opportunity to change to another trade should—within reasonable limitation—be permitted. It cannot be too strongly emphasized that the unwilling pupil is a poor learner, indeed.

15. It would seem inadvisable to train a man for an occupation which he can pursue only by use of specialized apparatus, adapted to the individual motor limitations imposed by his deformity. While a badly crippled man may be taught to operate a lathe with special treadles, or to run a typewriter with special paper feed and shifting mechanism, his employment opportunities will be precarious. It may be possible to secure for him one specific job which may be arranged for at the time he starts training. But if he cannot get along personally with his employer, if his family must move to another city, if his wages are not advanced as his product increases—for these and a myriad other reasons, he may become practically unable to obtain other employment, and the value of his training will be thus nullified. Ingenuity should be directed rather to fitting crippled men to meet the demands of standard trades, in which there will be not one or a dozen possible jobs, but thousands. Only thus can the man be made actually independent.

ABSTRACTS FROM THE LITERATURE OF PLASTIC AND ORAL SURGERY[1]

OFFICE OF THE SURGEON GENERAL, UNITED STATES ARMY

Section of Surgery of the Head

FRACTURES

1. COLE, P. P., and BUDD, C. H. Deformities of the Jaws Resulting from Operation or Injury. *Brit. Med. Jour.*, 1916, i, 268-271.

Deformities Resulting from Injuries.—The slightest inaccuracy in reëstablishing the correct relation of fragments in the lower jaw results in serious interference with function.

Wiring of the bone is condemned emphatically.

Every fracture of the mandible should be treated in terms of the upper jaw.

(*a*) *Fractures without Loss of Substance.*—No treatment is adequate which permits a margin for error. Where teeth are present on both sides, a cast interdental splint of aluminum is employed. Also a cast aluminum splint of the Gunning type.

(*b*) *Fractures with Loss of Substance.*—Usually compound both inside and outside the mouth. It is absolutely essential that these cases be treated from the beginning. The main fragments must be retained in correct relation with the upper jaw. All consideration as to union must be abandoned in favor of maintenance of correct alignment. The teeth are to be preserved wherever possible. Prevent deformity by early fixation in correct position. If deformity has occurred, rectify by surgical intervention followed by fixation. This is superior to apparatus for slow correction. Methods of fixation depend upon size and position of gap, and number and disposition of teeth remaining.

Necessary surgical measures will consist in plastic operations for reconstructing the damaged soft parts and introduction of bone grafts. In many cases, however, where teeth are present and properly placed, a lower denture can exercise the functions of an efficient splint.

Fractures in the region of the condyle should be treated in "open bite" position, thus obviating the crippling results of cicatricial contraction or callus formation.

2. COLYER, J. F. Treatment of Gunshot Injuries of the Jaws. *Jour. R. A. M. C.*, 1916, p. 597.

The writer states that the too early adaptation of a splint, by adding to the sepsis, may just alter the balance between life and death. The first aim is directed to saving the life of the patient. The next step is directed toward insuring the union of the jaw; if this can be carried out by restoring the contour of the jaw and the occlusion of the teeth, all the better, but if, by endeavoring to restore the contour of the jaw and occlusion, risk is run of obtaining non-union, then the ideal should give way to the practical, for it is far better for an individual to have a firm mandible and a moderate amount of maloeclusion than an ideal shaped bone which is unable to bear the stress of mastication. The masticating surface in a mandible, with malunion, can often be easily rendered efficient by artificial dentures.

General Routine of Treatment.—On admission, brief notes are taken and mouths cleansed either by mouth washes or frequent syringing with hydrogen peroxide, and once a day the gums are swabbed with 2 per cent iodine in alcohol. Skiagrams are obtained and models of mouth made. The next step is to anesthetize the patient and examine character of injury and see how far reduction of fracture is possible. Any sinuses present are also examined and treated, but no attempt is made to remove necrosed bone unless sequestrated. The necessary splints are made and adjusted if needful under an anesthetic.

Graduated Course of Diet in After-treatment.—(*a*) Fluids; (*b*) minced; (*c*) boiled; (*d*) ordinary. (*a*) Milk, beef tea, chicken broth, supplemented by extras. (*b*)

[1]Being a complete review of the war literature compiled in the office of the Surgeon General, United States Army, up to Jan. 1, 1918.

Minced chicken, minced ordinary diet, supplemented by minced fish, eggs and semi-fluid puddings. (*c*) Boiled ordinary diet, supplemented by fish, eggs, suet puddings, and toast. (*d*) Ordinary regulation diet.

Splints.—*Hammond's interdental wire splint* for cases with good teeth and no displacement. Rarely applicable.

Metal cap splint is by far the most useful.

Gunning metal or vulcanite splint used with the teeth in occlusion.

Wiring teeth.

Skull and Mandibular Splint.—Skull cap woven out of thick mercerized cotton and bordered by a rim of braid ¾ inch wide. Two hooks fitted on each side in front and one behind. Connected to metal mandibular splint which passes under the chin by means of tapes and, according to pressure exerted, one may obtain an upward or a backward pull. Used as an adjunct to interdental splints.

In fractures in region of molars, the posterior fragment is usually drawn up and in and meets the teeth of the opposing jaw. Anterior fragment slews round to injured side. If upward resistance to posterior fragment is removed by extraction of posterior teeth, the fragment will move still more upwards, but at the same time forward, and so bridge over the gap of lost tissue.

An important cause of non-union is the presence of septic teeth. Stress laid on the uselessness of plating septic comminuted fractures.

Closure of the jaws following fractures, and other injuries.— The use of a wooden screw gag is not satisfactory, as it may force the mouth open in an oblique direction. Equal distribution of force by means of apparatus is suggested. The mouth is screwed open at night and the gag remains in until morning. Apparatus consists of two curved plates covering the occlusal surfaces of the teeth, the teeth being united at each end by parallel screws supplied with nuts.

Treatment of Cicatrices.—Plastic operations can be rendered much easier, or even dispensed with, by preliminary treatment. When possible, models of the mouth are obtained and a vulcanite splint is constructed to bulge out the tissues in the region of cicatrices. The splint is made so as to fairly occlude with the upper teeth. The cicatrix and adjacent soft tissues are freely divided from the bone with a pair of scissors, the separation being made close to the bone. While the patient is under the anesthetic, the splint is placed in position and modelling composition firmly pressed in between the separated parts, and reconstruction of the splint completed. The wound in the mouth is then packed with gauze and the vulcanite splint placed in position within forty-eight hours. Additions may be made to the splint from time to time. Stretching of the tissues is assisted by regular massage.

In some cases with limited opening of the mouth, the splint may be attached to the external chin splint by wire passing from the mouth.

3. Frey, L. Views upon the Prosthetic Restoration of Fractures of the Maxillaries and Mutilation of the Face.

The fractures of the maxillaries, which we observe during the present war, are divided into two classes according to whether or not there is more or less destruction of the osseous tissue. Therefore we have fractures without any loss of substance and fractures with loss of substance. The former are the less frequent and in this special article they do not present any particular interest. They have for a long time been known and studied regarding their symptomatology, anatomy, pathologic physiology and treatment. These fractures of the the first class only deserve short mention, and their treatment is not unlike that described in all treatises on surgery.

Fractures with a loss of substance are those which we shall study here. The first class are known as fractures of times of peace; the second are more exclusively called the fractures of war. They are characterized by a more or less extensive loss of the bony tissue. The greatest mutilation of the tissue always corresponds to the orifice made by the exit of the missile. A splinter of shell is usually most destructive

The Different Stages of a Prosthetic Restoration.—Since there is a loss of tissue it is easily conceived that there must be different stages of procedure comprised in the restoration by the stomatologist. My personal experience allows me to establish four different stages:

First Stage.—The one or more remaining fragments of the maxillaries always,

show a tendency to deviate toward the least resistance. The masticating surfaces of the teeth lose contact with the surfaces of occlusion presented by the opposite teeth. In other words, the normal articulation disappears. The first stage is to reëstablish what remains of the masticating surfaces by bringing the fragments into a position which will allow the normal occlusion.

Second Stage.—The mere restoraton of the occlusion is not suffieient. Deviation shows a constant tendency to recur. The occlusion must be maintained.

Third Stage.—The mutilation has very deeply disturbed the dynamic equilibrium of mastication. The fragments remain—thanks to the support—in the proper position, but the masticating muscles do not act with equal force on the mutilated tissue. If there remains but one-half or two-thirds of the inferior maxillary, the molars alone meeting the upper teeth, the cuspids and incisors remain far distant from their antagonists. If all the median portion of the mandible is destroyed the two lateral fragments, although well maintained in position, act "en deux temps" individually; one of these fragments meeting the opposite molars before the other, synchronism ceasing to exist. It has to be reëstablished by forced exercises. (In other words, a very great deal of pressure brought to bear.) It is in this stage, too, that one must fight against the contraction of scars.

Fourth Stage.—The fourth stage consists in replacing the bones and the teeth that are missing—which might be termed the *mechanical.*

Importance of Each One of These Stages.—The four most important acts of prosthetic restorations are: Straightening, maintaining muscular equilibrium, dilatation of the scar, prosthesis.

Must they follow invariably in this order? Not necessarily. I think that the first diminishes and must lessen in importance in proportion as the wounded are sent directly from the ambulance, thanks to the wise steps taken by the Seventh Direction. I even think if the surgeon will call on our collaboration as soon as the wounded has recovered from his shock, there will be only a few exceptional cases where the straightening could not be effected. The principal thing is to keep the fragments in good occlusion. On this depends all the future mastication of the patient. Speech will even show the excellent effects of it and I would even say the appearance will be very much better. For whatever may be the extent of the wound, the restoration will be all the more perfect if the maxillary fragments have not deviated and function normally. By keeping these fragments in place one avoids their getting set in malposition by osteo-fibrous union. It frequently avoids the surgical intervention, often necessary, to readjust in their proper relations the fragments which have become so fixed in their malposition as to defy the forces brought to bear upon them by the stomatologist. (In other words, Dr. Frey wishes to emphatically convey the impression that a fixture applied to maintain normal occlusion does away with any necessity of having later on to perform a surgical operation to bring about such a result.) With the jaws held in their occlusion I have had occasion to observe, in spite of large losses of tissue, bony regenerations that have been most wonderful.

The third stage sometimes passes unperceived. As soon as the fragments are in good position, functioning can be reëstablished without any special intervention; but I cannot insist too strongly upon a constant and careful watchfulness. Muscular weaknesses may arise unexpectedly and the patient must be taught to observe his occlusion in a mirror. With the proper exercises he will learn to remedy certain partial malocclusions.

Regarding prosthesis, it is carried out either before or after the plastic operation. It is carried out before as a support to the plastic operation and follows when it replaces permanently the lost tissues. This latter prosthesis may replace a part of the maxilla with its teeth and it may even replace some of the soft tissues of the face.

The Apparatus.—What apparatus will be used during the four stages we have reviewed? The intermaxillary apparatus is intrabuccal, established between the two maxillaries. The point of support rests on one jaw, the force is exercised on the other or on a fragment of the other by means of the elasticity of rubber rings. On the upper jaw on each side a band is put around the molar teeth. To this band is soldered a little horizontal tube into the ends of which is fixed a metallic arch. This arch is ligated, of course, to all the teeth of the upper jaw. On this arch are soldered one or many little hooks. On the fragment of the inferior maxillary which one wishes to displace, one inserts bands and a small arch with hooks. In a word, the apparatus is like the one of the upper maxillary (excepting in many instance they are separate parts and not soldered together as one whole, they vary according to the case). These two systems of anchorage are united through the hooks by one or more rubber

rings according to the intensity of the force to be employed and, on account of this continuous and progressive traction according to the number of rubber rings, the deviated fragment finds again its normal position.

This intermaxillary force is employed principally when there has been a loss of substance at the angle or a part of the body of the maxillary to reduce the lateral and retrogressive deviations of the maxillary. It is indicated when the retraction allows a certain mobility, otherwise, if there is absolute fixity, the intervention of the surgeon is imperative. When the teeth are missing on both maxillaries, or when they are too bad to bear the bands of the apparatus, or when both maxillaries, inferior and superior, are fractured, the point of support must be retained by the cranium. (Describes the unique apparatus made at the front for Ozanne's case.) The apparatus must be fixed very firmly, as it must remain in place for a long time. It must allow bony growth to take place, if possible, and the surgeon will often depend for the success of his case upon bone grafting, an operation which tends to find favor more and more in France and abroad.

As far as prosthetic restoration goes, I cannot add anything to the admirable book of Claude Martin (of Lyon). There is not a prosthetic dentist who is not a modest pupil of this wonderful genius, not only for the maxillary prosthesis, but also for the nasal prosthesis.

Judging from this short account it is very easy for one to realize the important part played by the dentist during this war, in which the wounds of the face and the maxillaries are so numerous.

4. Hayes, G. B, War Dental Surgery. *Dental Cosmos*, 1916, lviii, 249, 389, 511, 658, 758, 1012, 1143.

These articles consist of a most interesting and instructive series of case reports from the American Ambulance in Paris. To obtain real benefit from the articles they should be read in their original form. They are especially valuable on account of the illustrations, which cannot be presented here.

5. Herpin, A. Treatment of Fractures of the Lower Jaw at the Center of Bordeaux. *Gaz. Hebd. de Soc. Med. de Bordeaux.* xxxviii, 43–45.

Fractures are anatomically divided into two varieties—those of the horizontal ramus and those of the ascending ramus and angle.

In treatment, the aim should be reëstablishment of the function of mastication. This is only possible if the general equilibrium of the system is preserved, if the occlusion of the teeth is normal. And that can only be realized by reconstitution of the primary length of the bone.

In treatment, therefore, the first consideration is to reëstablish the normal occlusion of the teeth of the two jaws. For the horizontal ramus, we use, oftenest, ligation of the two arches with the mouth closed. The results are rapid and deviation of the body of the bone is reduced to a minimum. This is an excellent means of temporary treatment which insures security of the jaw while proceeding with permanent pieces. In case of overcrowding of wounded, we employ it systematically with this end in view, even when easy reduction would permit the immediate making of the permanent prosthesis. We thus avoid the deviations which might be formed during the waiting period. In certain favorable cases, the teeth being preserved, this immobilization can be maintained until consolidation takes place.

After reduction has been effected, we immediately install the permanent prosthesis, whether this reduction has been made extemporaneously by means of ligature in old cases, by the apparatus of Angle, etc.; or whether in obstinate cases one has had recourse to a section of fibrous bands.

For this permanent prosthesis, we employ bridge apparatus; it is evident that the best procedure of retention is that which achieves, at the same time, the prosthetic replacement. Besides, thanks to employment of these bridge apparatus, the function of mastication is immediately reëstablished and the patient is in the best condition for bony repair to take place. These bridges are fixed, in most cases, and removable when they must have prolongations on the portions deprived of teeth.

For lesions of the angle and ascending ramus, we employ saddle apparatus (*volet*). These, in favorable cases, where reduction of the ascending ramus in its normal direction can be made from the first, are fixed. If this presents difficulties, the posterior saddle is provided with an arrangement which allows its progressive extension. Little by little the ascending ramus is thus pushed back and, by the

resistance it presents, the anterior fragment finds itself naturally replaced in its normal situation of articulation.

To sum up, the apparatus that we employ are as limited in number as they are simple in construction. We lay stress upon reëstablishing function as rapidly as possible and, in order to do this, obtaining an absolutely accurate articulation of the two arches, which is only possible with a perfect reconstitution of the bone, in its dimensions, and in the direction of its different portions.

Although simple, these apparatus must not be the less formed and installed with an attention that leaves nothing to chance.

During nine months—June 1, 1916, to March 1, 1917—906 fractures have been treated at the center of Bordeaux according to these methods. The average duration of treatment is one month, with another month for convalescence. Grafts are not indicated for recent cases which have been immobilized immediately. The fragments are never brought together where there is loss of substance. Grafts are only indicated in old cases which have not had early and proper treatment.

6. Herpin, A, Chef. de Service de Stomatologie de la xviii Region. Treatment of Fractures of the Horizontal Portion of the Mandible. *Presse Medicale*, 1916.

The principal object of treatment of fractures of the mandible is restoration of the function of mastication. To bring this about, two conditions are essential: (1) Reconstitution of the normal occlusion of the teeth of the two jaws; (2) reconstruction of the arch of mandibular resistance. In fact, the displaced fragments should be replaced in good position and held until consolidation.

At the time of receipt of the wound, and immediately afterward, the fragments are mobile; they are reduced with the greatest facility, without pain, and the treatment then is reduced to the application of a suitable retaining appliance.

But it is rare, in practice, that the problem is presented with this simplicity; the evacuation of the wounded into the interior is slow, in the course of which the lesions grow worse; displacements are accentuated, the parts undergo adhesions which fix them in vicious position, and reduction becomes more and more difficult and complicated. Also, the duration of time required for treatment, easy and rapid at first, takes on an importance that tends to become preponderant. Various procedures have been invented; different apparatus for a slow reduction, which may last for weeks or months. The resistances to be overcome are often considerable, conditions unfavorable, and one thus often only achieves an approximate final result. The teeth may be in contact, but the masticating surfaces no longer exactly correspond, the bone being most often everted under the influence of the pressure or traction which has only been able to operate definitely on the teeth, and which have no efficacious action upon the bone itself. Besides, the splints which avoid normal contact of the teeth of the two jaws are not without ill effect upon the ultimate occlusion of these organs. No matter the care with which a splint has been articulated, most often, when one removes it, a deviation is found which is always very difficult to reduce. Besides, the result can very easily not be permanent. Stretched and undestroyed bands often tend to bring back the bone into its vicious situation, as soon as the action of the apparatus is discontinued.

For these reasons we believe preferable, immediate, quick surgical reduction, followed by immobilization of the fragments. It is a benign intervention, section of a few fibro-mucous bands cannot cause an appreciable shock; in any case, the betterment of the general condition of the patient, rapidly regaining an essential function, sets off largely any possible inconvenience; on the contrary, it can only be medioere in those who, fatigued by wearing tiresome painful apparatus, can only receive, on the other hand, insufficient substantial diet, their ability to masticate being reduced or suppressed. This intervention should only be performed upon the soft tissues; the bony parts, even isolated, which one sees so frequently serve as guides to new bone formation, must be respected.

This liberation leads us back to the conditions which we had at first, those of the moment which followed receipt of the wound. Nothing remains but to see to the retaining in good position.

In cases of fracture of the horizontal portion with preservation of some teeth on either side of the loss of substance, cases which are happily the most frequent, it has appeared to us possible to employ apparatus which realizes both fixation and indispensable restorative prothesis. These two conditions are fulfilled by bridges fixed solidly on the dental abutments; absolutely rigid, they are capable of retaining the fragments in an efficient manner, reconstituting thus an efficient mandibular arch.

Furthermore, they carry artificial teeth, and the patient can retain them indefinitely. They should be constructed in such a manner that the linear length of the arch is re-established in rigorously exact fashion; under these conditions the teeth take their normal occlusion and deviation is not observed. In cases favorable from the first, a bridge of a single piece is made; if intervention has been necessary, one can, if need be, in complicated cases establish a bridge in sections, two lateral portions corresponding to the preserved teeth, and which is attached to them before the operation—and a central portion which is united to the two others right after the operation. They are assembled by means of screws and grooves installed in such a manner that the entire piece has perfect rigidity. Immediately after placing these appliances the patient can go back to normal diet and the difficulties of swallowing and phonation are done away with. The employment of these apparatus has never given us anything but satisfaction.

The consolidation of war fractures of the lower jaw can only be brought about by a very considerable new bone formation, to fill the breach caused by the traumatism. The process of repaid is fairly long, but this fact does not entail great difficulties, since from the start of treatment function is reëstablished. We have had occasion to observe that consolidation was more frequent and more rapid in cases submitted to the foregoing treatment. The time of repair varies, but we have seen new bone formation of 4½ cm. produced in 2½ months.

The last two conditions are fulfilled by fixed bridge apparatus. We consider that osteogenic evolution will be so much the more favorable as the fracture is situated in front of the last molar. Moreover, new bone formation always occurs from behind forward for each half of the mandible, progressing toward the anterior fragment; the anterior portions are in fact deprived of sufficient nutrition. Nutrition and blood supply are augmented by normal functioning of the jaws.

It is preferable to avoid, whenever possible, the lacing of the upper and lower jaws together, as this creates a local anemia. As to the grafts which have been attempted, the results have not yet been very well demonstrated. One should be very reserved in employing them, and they are only found necessary in a limited number of cases.

7. Herpin, A. Fractures of the Angle and of the Ascending Ramus of the Mandible. *Presse Medicale*, 1916.

The ascending ramus, after bony section, is drawn principally upward, and its direction becomes oblique forward and downward. If consolidation occurs under these conditions, the equilibrium of the entire bone is destroyed. The corresponding horizontal fragment is at its posterior extremity bronght upward and backward, causing a marked obliquity, whence arise a limitation of opening on the affected side and muscular disequilibrium betraying itself by diminution of function.

The shortening of the arch does not permit the normal articulation of the teeth; besides, the implantation of the latter not having changed, they take on oblique direction upward and forward, and pressure is no longer exerted in the direction of greatest resistance, consequently there is a tendency to dislocate the teeth forward in the course of mastication; lesions of rarefying osteitis become manifest about the roots; the teeth loosen and fall out. Fixed or removable prostheses thus have supports of diminished resistance which soon are lost. Mastication is impossible on these teeth painful to pressure and, by their premature disappearance, is found to be gravely interfered with. Also in most cases the mobility resulting from the non-fixation favors the production of a pseudarthrosis; the deviation of the anterior fragment necessitates the employment of special apparatus, with rods, destined to put it in good articulation. But this prosthesis is only a palliative, which makes a lesion that has become permanent. The patient is condemned indefinitely to wear complicated prostheses. A marked deviation persists on opening the mouth.

The first care, then, should be to avoid the establishment of these lesions, and consequently the employment of these improvised means of correction.

If, from the moment of arrival of the patient, the position taken by the ascending ramus is considered, if its deviation is reduced, if this reduction is maintained, ths general mechanism of the system is reëstablished in its integrity. These resulte are easily attained. For a short time after the receipt of the wound, reduction is easy. After this, there is nothing further to do than to apply an apparatus (*à volet*) supported on the preserved teeth and carrying a sort of saddle of vulcanite, which adjusts itself on the anterior border and the inner surface of the ascending ramus. If the apparatus is constructed with care, in such a way as to reëstablish the articu-

lation perfectly, to maintain the ramus in a direction exactly parallel with that of the healthy side, the exact length of the mandible is reestablished. The pressure exerted on the ramus suffices to lead the remaining teeth into good occlusion, and from the moment of placing it in the mouth the patient can have normal mastication. The apparatus, well adjusted, is always well borne. We employ a removable piece, which allows observation of the tolerance of the mucous membrane. In certain cases, where reduction is less easy, the piece is installed on a slide with an eccentric screw, permitting the forcing back of the ascending ramus and, at the same time, forward and outward, the horizontal ramus. We have found that, treated in this manner, the fractures have a tendency to consolidate rapidly. The waiting period, moreover, is bearable, thanks to the immediate rëestablishment of function.

8. Imbert L., and Real, P. Unilateral Fractures of Mandible with Loss of Substance. Their Treatment by the Swinging Forward of the Posterior Fragment. *Brit. Dent. Jour.*, 1917, xxxviii, 45-52.

These authors believe it necessary to obtain approximation of bony fragments at the expense of restoration of normal contour of the bone, thus avoiding fibrous union and pseudarthrosis.

Summary.—1. It is of the utmost importance, in order to secure consolidation of the fracture, to draw together the fragments.

2. The shrinkage of the jaw which results from this is of minor importance, even where there has been loss of continuity amounting to as much as 2½ or 3 cm.

3. This shrinkage is no obstacle to rëestablishment of function, for the normal movements of the temporo-mandibular articulation admit of remedying the defects of occlusion.

The authors use crowns on the teeth of the posterior fragment, to which are soldered wires with a jackscrew attachment to a wire arch fitting inside or outside the teeth of the anterior fragment. Deviation of the anterior fragment is corrected by intermaxillary elastic traction.

9. Kazanjian, V. H. Immediate Treatment of Gunshot Fractures of the Jaws. *Jour. Allied Dental Soc.*, N. Y., 1917, xii, 29-48.

Actual destruction and loss of soft tissues in gunshot injuries of face are uncommon, and torn and separated borders of very large wounds can usually be traced.

Many soldiers, when wounded in jaws, do not lose consciousness, but are able to take care of themselves to the extent of stopping hemorrhage, and even of walking some distance to have wounds dressed. When found unconscious and bleeding freely, they receive field dressing and are sent along to base hospitals within two or four days. Wounds are always septic and inflamed. Even the slightly wounded show weakness and fatigue, and the seriously wounded are very ill. Effective care and prophylactic treatment, proper diet, frequent dressings, etc., reduce temperature, but for the first two or three weeks the patient is very weak. Recovery of strength is gradual and may be marked by bronchial and tonsillar infections.

A conservative estimate of time for recovery from fractures is two to nine months.

If the injuries are limited to the jaws and mouth, prognosis as to life is good.

Conditions which may cause immediate death are:

1. Secondary hemorrhage. Extreme care and watchfulness are necessary for this.

2. Extensive inflammation and suppuration in mouth may cause pneumonia.

3. Extensive fracture of upper jaw may involve cranial bones and lead to brain complications.

Treatment.—The presence of dangerous illness may be the first consideration. As soon as the general condition warrants it, the proper steps are taken to restore the normal function of the jaws and reduce possible deformities of the face.

Methods used are:

1. Care of mouth and external wound.
2. Diet.
3. Operative procedure.
4. Splints and immobilization of bones.

1. *Care of Mouth and External Wound.*—Before arrival at general hospital, patient has received such treatment as will arrest primary hemorrhage and clean wounds and mouth.

On arrival at general hospital, usually within three or four days, patient is put to bed. Free drainage of external wounds and hypochlorous acid (eusol) dressings applied in form of hot fomentations. Until initial shock and weakness have disappeared, no immediate attempt by operation is made to suture soft parts, set bones, or remove foreign body, except operations necessary to save life. Hypnotics are given for pain, and cathartics for bowels.

To establish and maintain cleanliness of the mouth:

(*a*) Tinct. iodine applied two or three times a week to gums and teeth on small cotton wads.

(*b*) Pledgets of cotton saturated with hydrogen peroxide and rubbed over teeth and all mucous surfaces twice daily.

(*c*) Mouth is irrigated with an antiseptic fluid three or four times a day.

(*d*) Hard deposits scaled from teeth and surfaces polished. Mouth gradually cleared of broken roots and fragments. When able, patient cleans own teeth with brush.

(*e*) Wounds of the mouth are at times packed with iodized gauze, changed frequently.

(*f*) For excessive salivation, hand saliva ejectors are used by the patient.

(*g*) To facilitate the removal of pus, sputum and dried secretions, etc., exposed parts are sprayed with

Ol. menth. pip.	M ss
Liq. cresol. comp.	M ij
Paraff. liq.	Oz j

2 *Diet.*—Liquid food is given either through a porcelain feeder or through a rubber tube which can be carried far back in the mouth. Patient loses weight at first, but even on liquid diet for two or three months he begins to gain steadily.

SUMMARY OF DIETARY

Acute Injury of Jaw

Liquid through esophageal tube or mouth tube.

Every 2 hours during day.

Every 4 hours during night.

Milk, 1 pt., egg 1, or strong soup, or Benger's food, with egg or Bovril made with milk, or thin arrowroot with Valentines meat juice, or boiled custard with addition of stimulants—brandy or port wine as ordered.

Basis of dietary, 24 hours.

Milk, 4 pts.; eggs, 4; soup, 2 pts.

Semiliquid Dietary for Convalescent Patients

Same as above in 4 hourly feeds.

In addition:

Baked custard.
Strained fruit juice or stewed fruit.
Jelly.
Benger's food.
Bread and milk.
Porridge (per diem).

Convalescent—Semisolid

Breakfast: 7.45 a. m.

Porridge 1 pt., milk 1 pt., sugar. Tea, thin bread and butter. Alternative bread and milk or gruel.

Luncheon: 11.00 a. m.

Bread and milk or beef tea with bread.

Dinner: 1.00 p. m.

Minced meat, mashed potatoes, greens. Milk pudding.

Tea: 4.00 p. m.

Tea, or bread and milk; 2 eggs lightly boiled, poached, fried or scrambled. Bread and butter.

Supper: 7.00 p. m.

Cocoa 1 pt., or bread and milk.

3. *Operative Procedures.*

Removal of foreign substances.—In order to control suppuration it is necessary to remove all irritating agents, such as bullets, affected teeth and roots, and loose fragments of bone. Fractured alveolar process is not worth saving, nor teeth and roots involved in the fracture, nor loose and scattered fragments of bone.

Ascertain the path of the projectile, so as to know beforehand all possible sources of bleeding.

Bleeding from the lingual artery may often be controlled by local packing frequently repeated. A specially devised lingual clamp is also useful. This consists of a piece of heavy wire 8 or 10 inches long bent to a "U" shape, with a finger of modelling compound or vulcanite on each end. One end passes under the tongue and the other under the chin, with an elastic band to make pressure.

One-fifth of the patients with fractured jaws develop bronchitis or bronchopneumonia. This is often due to use of general anesthesia in these septic mouth cases for operations on other parts of the body. Always clean and irrigate the mouth before general anesthesia. Avoid morphine when possible as it may paralyze the laryngeal reflex. Use atropine alone for preanesthetic medication. Keep patient in sitting position if possible.

Abscess and Necrosis.—Extra and intraoral drainage are essential.

Development of secondary abscesses can be largely avoided by strict attention to the hygiene of the mouth and careful removal of all foreign bodies and detached fragments. Free drainage is essential until all suppuration stops.

Local Anesthesia.—Cannot be overestimated in value. By conductive or infiltrative methods, wounds may be curetted; teeth, loose alveolar process, and superficially embedded foreign bodies removed; abscesses opened; perforations of the palate sutured; muscular and fibrous adhesions cut; displacements reduced in the adjustment of splints, and smaller plastic operations performed.

Plastic Operations.—No attempt should be made to suture the soft parts with the idea of closing a gap until such time as union of the fractured parts in correct relation is well under way and permanent splints are adjusted. The reasons for this are that wounds are always septic at first stages, displacement of fragments is nearly always present, and the muscles of the face are nearly always in constant tension. As a result any wound involving lips or cheek is magnified. On the other hand, if mouth is cleaned, infection controlled, and displacement reduced, disfigurement will be much less and therefore easier to rectify. Long delay is not necessary nor should we wait until scar tissue is formed. As soon as splints are adjusted and wounds show healthy granulation, parts should be sutured to obtain minimum scar tissue.

Facial supports are of great assistance in moulding the parts and supporting the sutures. A simple support is made in the following manner—ordinary hooks are sewed close together to the edge of strong bandage material. A piece of this is stuck to the face with collodion on either side of the sutured portion of the soft tissue and the two laced together with silk. Or hooks may be sewed to adhesive tape.

Another form of facial support is one in which a series of plates of vulcanized rubber, held in place about the face and cheeks by head gear, serves as a base. To this are attached heavy wires, with vulcanite fingers on the ends to press the tissues at certain places and offset muscular tension. There are many possibilities for additions and variations, such as tubes to serve as nostrils, etc.

4. *Immobilization of the Bones.*—This is done preferably within a few days, while the fractured parts can be moved freely. Permanent splints cannot always be applied in the early stages, but temporary attachments can generally be made. *The guide for correct immobilization of the maxillary bones is the former occlusion of the teeth. This cannot be over-emphasized.*

Classification of Fractures.—(*a*) Single fractures anterior to last existing tooth. The ease and speed of making render the jacket vulcanite splint especially adaptable for military surgery. Consists of vulcanized rubber over teeth adjacent to fracture, having fractured parts connected by heavy wire vulcanized into rubber. Cemented on teeth.

Cast or swaged jacket splints of gold, aluminum, or german silver are superior to vulcanite, but construction is more difficult.

Band and wire splint, by fitting bands to selected teeth and connecting by wire clingually or bucally to them, is an excellent appliance. The different steps in preparation, however, may cause discomfort to the patient if his condition is weak.

(*b*) Multiple fractures anterior to last existing tooth. Usually much displacement. Under favorable conditions, the types of splint described for class (a) may be used, but if assembly is difficult, a sectional band and wire splint may be used. This means two band and wire splints, applied to selected teeth in each fractured

portion, with corrugated arch wires elongated anteriorly to pass each other at median line. Then wire or silk ligatures bind the overlapping wires firmly together.

(c) Fractures posterior to the last existing tooth. These involve fractures of the body of the bone, ramus or condyle. Immobilization is secured by using the superior maxilla as anchorage and occlusal guide. If this is done, patient cannot masticate, and drainage of septic mouths is interfered with. Immobilization may also be followed by ankylosis. Removable intermaxillary splints are therefore desirable until wounds have healed.

1. Intermaxillary (Gunning) splint of vulcanite or metal, is easily removable and suited as temporary splint.

2. Intermaxillary ligation by metal, or band and wire splints. Ligatures may be removed and mouth opened at any time.

3. Interdental ligation with fine brass wires applied directly to the teeth has limited field in war fractures, except occasionally as temporary measure.

In injury of the joint or neck of condyle, permanent immobilization must be avoided. The mandible should be at rest, yet moderate movement encouraged. The intermaxillary wiring used in other fractures should be replaced by elastic ligatures.

Modelling composition may be attached to splints to mold and build out soft parts.

Fractures of Maxilla or Upper Jaw.—Modified Kingsley bar splint attached to head straps.

Treatment of Delayed Cases.—Reduction and fixation brought about by

1. Continuous force by use of springs and rubber bands.
2. Jackscrew.
3. Inclined planes.

Bandages.—The most useful is the Barton bandage. The turn under the chin is passed in the direction in which force is required.

10. Massobrio, G. War Fractures of the Mandible and their Surgical Treatment. *Policlin*, Rome, 1917, xxiv, 993.

The author thinks that displacement of the ascending branch of the mandible is especially grave, and that its reduction is a problem not yet solved by many surgeons. The author is inclined to think that this could be effected by nail extension applied precisely on the ascending branch of the mandible.

When there is loss of substance, it is best not to attempt grafting in the first instance, but while the fragments are maintained in position, to allow periosteal regeneration. The periosteum, according to the author's observation, can, when its functions are not interfered with, reproduce a large portion of the lost bone, and a dental prosthesis only, will finally be necessary. When such a regeneration fails, it will then be time enough to resort to bone or cartilage grafts. This should be done as a late operation, when all inflammatory reaction has ceased. The surgical treatment of mandibular fractures thus resolves itself into a first stage of mechanical prosthesis, and a later stage of bone substitution. In the author's opinion, too little attention has been given to internal prosthesis.

11. Pickerill, H. P. Treatment of Fractures of the Mandible Accompanying Gun-shot Wounds. *Dominion Dental Journal*, 1917, xxix, 217.

Fractures of the anterior portion of the jaw involving the incisor region lead to (1) narrowing of the arch of the jaw, and (2) twisting inwards of each horizontal ramus, brought about chiefly by the action of the mylohyoid muscle.

Fractures of the posterior portion of the mandible lead to (1) considerable elevation of the posterior fragment (temporal and masseter muscles), (2) retraction and deflection of the chin; (3) depression of the larger fragment on the injured side. (2) and (3) are due to the unopposed actions of the geniohyoid, hyoglossus, and mylohyoid muscles. As part of the conditions bearing upon treatment, it has to be remembered that many of the men have either (1) lost a large number of teeth; (2) have a large number of septic teeth present; or (3) were wearing dentures, which disappeared at the time of injury.

Suggested Immediate Methodsof Treatment.— 1. *Splint.* Modified Kingsley splint adopted by the New Zealand Government. Made of nickle-silver, glided, and consists of a body and two arms. The body is concave and molded to the shape of a

dental arch. Arms are made of stout wire soldered to body. The concavity is filled with modelling composition. The splints are made in three sizes, small, medium, and large. The Pickerill splint provides a ready-made splint for any case. It can be used for simple and compound fractures and also in cases where a portion of the bone is missing, to maintain the relative position of the two fragments, and especially to counteract the upward displacement of the posterior fragment. It can be removed and replaced without difficulty for dressing wounds. It may be used advantageously in combination with wiring.

Directions for Use.—(1) Splints are provided in three sizes, large, medium, and small. Select one which is of the approximate size required. (2) Remove the modelling composition by placing the splint in hot water. (3) Try splint in mouth over teeth. If too deep at any point, trim down with the scissors provided, leaving no sharp edges. Make any other adaptation with the pliers provided. (4) Heat the composition in hot water and replace in the dried and warm splint. Whilst the composition is still warm, press splint down into position over the teeth and jaw, observing (i) that the composition is not too hot, (ii) that the fragments are in normal position. (5) Pass a bandage under the mandible up between each arm of the splint and the cheek, over the arm and down under the mandible and tie it firmly. The jaw is thus securely clamped. (A pair of pliers and a pair of small metal scissors are sent with each batch of splints.)

2. *Intermaxillary Lacing.*—Two horizontal ligatures are first passed through the interdental spaces between the canine and first premolar, and the second premolar and first molar in both jaws, so as to include the two premolar teeth. This should be done on both sides of the jaw. Horizontal ligatures are then connected by vertical ligatures, all the wires being applied quite loosely. The horizontal wires are next tightened, and then the lower teeth are made to articulate absolutely accurately with the upper teeth, and while in this position the vertical wires are tightened and the jaw thus immobilized. The method may be used as a temporary measure in all fractures of the mandible. The vertical wire ligatures are left on for three weeks, after which in some cases they may be removed and passive movements allowed; they may be replaced by silk ligatures as easier to apply. The horizontal ligature is continued until the sixth week, especially during the time the patient sleeps, in order to prevent yawning, as the latter does far more harm than even a small amount of mastication. In the absence of teeth, intermaxillary lacing is carried out as follows: (1) Holes are drilled through the jaw at the level of the roots of the teeth, and about ¾ inch away from each fracture line. Stout silver wire is then passed through the holes, and the fragments approximated if possible. (2) Further holes are drilled in the region of the lateral incisors in both upper and lower jaws, or in other suitable positions, according to the site of the fracture, and silver wire passed through both. The mandible is brought into the desired position, and the wire tightened by twisting.

3. *Submandibular Screws and Wire Splint.*—In cases in which none of the other above described methods are available for some reason, such as an extremely septic mouth or the loss of much alveolar process, the following method may be adopted:

(1) A very stout piece of German silver (or even iron) wire is obtained and bent to the shape of the lower border of the mandible—as the latter should be normally, and extending from angle to angle. Four steel screws 1 inch or 1½ inches long, and preferably nickel plated, are required, and some fine silver or brass wire for ligatures. (2) The skin under the mandible is sterilized, and four small incisions made directly over the lower border of the bone, two on each side of the fracture line (avoiding the facial arteries). Holes are bored in the bone for the reception of the screws, and the latter screwed in for about half an inch. The stout wire splint is then ligatured firmly to the four screws with fine ligature wire, and the mandible securely clamped. Every effort is made to prevent infection from reaching the screws, or they may become loose before the fracture has united. The stout wire should be notched in the region of the screws, so that the wire ligatures will not slip.

12. Pont, M. A. Treatment of Fractures of the Lower Jaw. *Lyon, Med.*, 1916, cxxv, 294.

Fractures of the mandible can be divided into three categories:

(*a*) Recent, without loss of substance; (*b*). old without loss of substance; (*c*) Old or recent with loss of substance.

1. Recent fractures without loss of substance.—These, being handled in time in special centers, unite in perfect manner in all or nearly all cases.

In no case should one employ bony suture or retention plates in the treatment of these fractures. It is always better to reduce the fragments and maintain them in good position by means of retention apparatus. The most simple and preferable apparatus is the metal arch or the arch of Angle which has the advantage of not requiring preliminary impressions and of serving at the same time for reduction and retention.

2. Old fractures without loss of substance.—In this variety of fractures, the fragments are in general overriding and deviated. Two methods are employed to re-establish the normal occlusion of the teeth.

(*a*) The slow or prosthetic method by means of apparatus of reduction, then of retention.

(*b*) Rapid or surgical method (osteotomy) employed when the osseous callus is too old, and the fracture cannot be reduced by prosthetic apparatus.

The technique is as follows: After cutaneous incision the mandible is bared, and with the help of a simple gouge inserted in the line of fracture the fragments are separated. It is preferable not to employ the Gigli saw, this procedure being able to provoke later formation of secondary fragments with suppuration and pseudarthrosis. The mobility and the reduction of the fragments being thus obtained, one proceeds to the immediate placing of the retention apparatus.

3. Old or recent fractures with loss of substance.—Following these fractures a pseudarthrosis is usually observed. Different procedures have been employed to combat this pseudarthrosis. I eliminate at once the osseous suture which immobilizes the jaw badly. The plate of Lambotte can give at times appreciable results, but has the great disadvantage of not reëstablishing normally the dental articulation. Besides, these means of retention are, in general, badly tolerated, and I have been obliged generally to remove them to avoid an abundant suppuration and the elimination of sequestra.

I prefer to employ the bony graft, which up to now has given me good and quickly appreciable results.

The first time that I tried this operation, with the aid of Dr. Patel, the graft was removed from the cartilage of the eighth rib. This graft was thrown off three weeks after the operation. Nevertheless the result obtained was satisfying from the point of view of bony consolidation. This patient has now a dental apparatus with which he masticates very well. But the removal of the costal graft presents some dangers. It is then preferable to take it from another part of the body and in particular from one of the bones of the leg.

For the bony graft of the mandible, it seems that the tibia is preferable to the fibula. It is not necessary to have a voluminous graft. On the other hand, a special technique allows the graft to be removed without too much harming the tibia. It is removed generally from the antero-internal surface of this bone. For this purpose I employ the technique of Dr. Bryan, of New York. The surgeon uses a double circular saw driven by an electric motor. I have simplified and slightly modified this method. Never should bone grafting be performed hastily, and in certain cases it should be renounced absolutely. In fact, for this procedure to give appreciable results, it is indispensable to be sure of perfect fixation; it is necessary then that there be teeth solidly implanted behind the line of fracture. I employ two metallic arches, one placed on the superior maxilla, the other on the inferior, and solidly ligatured between them. The mouth is thus maintained in perfect occlusion. This procedure, which carries the name of "blocking," has been employed not only for the retention of the bony graft, but also in the cases of fracture difficult to retain in perfect immobilization. It is not always without hesitation that I have practiced it. I feared troubles of nutrition in wounded already debilitated, their nourishment being thus rendered particularly difficult. The patient should be over-fed, the food being liquid or semiliquid.

Here is the diet of the "blocked" at Hospital 19: 3 liters of milk; 4 eggs, 1 liter of bouillon; 100 grams of meat juice; 1 quart of wine. The patients are weighed every four days and, in every case except one, the weight has been maintained and even sometimes augmented.

Cases of bony regeneration have been demonstrated among patients with pseudarthroses, with large losses of substance, when immobilization of the jaws had been maintained during several months.

On the other hand, it is often impossible to perform bone grafting, particularly in older patients. The bones have no longer the vitality necessary to recon-

struct themselves, and further, the blocking can bring about serious stomach troubles in these patients, more weakened than others who are younger and better able to bear this special feeding. In these cases I replace the missing part by a gold bridge fixed solidly to the existing teeth, and upon which is placed the prosthetic dental apparatus.

13. Pullen, H. A. A Quickly Adjustable Fracture Band, and its Possibilities in War Dental Surgery. *Internat. Jour. Orthodontia*, St. Louis, 1917, iii, 139-141.

German silver band (thin gauge) which has soldered across each end a short curved section of heavy German silver wire, which, by reason of the projecting horns thus formed, is readily ligated on the labial or the buccal surface of a tooth by twisting brass wire around the horns. The band automatically conforms to the narrow neck of a tooth by twisting of the labial ligature as the force is exerted in parallel lines across the horns, and continues to tighten the gingival edge of the band after it has already become tight at the coronal edge, preventing the band from slipping off under the strain of ligatures from the opposite jaw.

Bands of this form could be joined together with a section of a heavy soft solder wire, to be used as an arch between the fractured sections as a temporary splint.

14. Schroeder, H. On the Treatment of Wounds of the Jaws in Field and Base hospitals. *Beitr. z. klin. Chir.*, 1915, xevii, 320.

In ordinary times, the stationary nature of trench warfare permits of the complete handling of these cases in the hospitals near the front. In times of stress and congestion, most wounds of the jaws must often be passed farther back for complete treatment, after an emergency dressing has been applied in the field hospital.

The fixation apparatus employed in the majority of cases is the Sauer wire splint, with or without inclined planes. The splint, consisting of a wire arch on the bucco-labial surfaces of the teeth alone or passing around on to the lingual surface as well, is fixed to certain teeth by means of clamp bands. These bands resemble those known in America as the Usona type, and differ from the Angle bands in that they are heavier, and the bolt drawing together the clamp is on the buccal side of the tooth, and is hollow, forming a tube for the reception of the wire arch. The arch is also firmly ligated to the teeth intervening between the bands with fine wire. Where moderate loss of bone substance is present, elastic traction is made use of by rubber bands passing obliquely from the upper to the lower teeth, in order to restore the correct occlusion. For cases with extensive loss of substance, the emergency dental equipment chest is provided with artificial hard rubber jaws, to be used as temporary prosthesis.

The author is a strong advocate of the principle that in every patient with jaw fracture, whatever the method of treatment employed, under all conditions the normal articulation of the denture must be preserved.

Fourteen cases are very fully described, illustrating the author's methods of treatment under various conditions. In one case of fracture of the lower jaw, with considerable lateral loss of substance and deviation of the greater fragment to the injured side, the normal position was restored by means of elastic and adhesive plaster traction, the distal end of the elastic being attached to a chair beside the bed.

15. Valadier, A. C., and Whale, H. L. Report on Oral and Plastic Surgery, and on Prosthetic Appliances. *Brit. Jour. Surg.*, July, 1917.

These authors believe in the early closure of the soft tissues, by flaps if necessary, at the same time preserving the original contour of the bone by means of splints, building out with modelling composition, etc.

Extensive experience in gunshot fractures of the jaws has shown that each case must be treated as one *sui generis*. The plastic side of the work is most important. Oral and plastic work are mutually interdependent.

The following principles are formulated:

1. All remaining teeth should be preserved as far as possible, even old roots may be kept and filled, and may prove useful in providing support for interdental splints. Teeth directly in the line of fracture should be removed, but more conservatism should be observed in regard to the teeth than is usual.

2. In extensive injuries of the face, the wounds should be closed as soon as

possible; if necessary, before placing the jaws in position. The wound should be closed long before it is thoroughly clean. Two layers of sutures, one deep and one superficial, are used. Drainage of the mouth should be obtained by a median submaxillary stab wound into which a rubber tube is inserted. *Where there has been a loss of tissue in the upper or lower lip,* however, it is unwise to draw the edges together.

3. Where the initial closure of the soft parts precedes the orthodontal correction, there is a strong tendency for the soft parts to shrink into cicatrization. This renders work on the jaw itself difficult or impossible and, to prevent it, interdental appliances, to which wire has been attached for the grasping of modelling composition, must be inserted, and increased, if necessary, to preserve the contour.

4. Superficial sutures must not be subjected to undue tension, even if complete apposition of the wound edges is not obtained.

Prosthetic Appliances.—Cases differ so much that the decision in each instance must remain with the operator. Endeavors should be made to keep the appliance as simple as possible, avoiding unnecessarily complicated methods.

Trismus can be treated satisfactorily without complicated appliances. Treatment by plain wooden wedges, larger sizes being provided progressively, should give satisfactory response to treatment within five or six days at the utmost.

CHIEF COMPLICATIONS AND SEQUELAE

1. *Secondary Hemorrhage.*—A slight oozing is fairly common. Out of 1,010 cases, it has been necessary to tie an artery in its continuity through a fresh incision in only 11. In severe bleeding, the routine practice is to tie at once the external carotid artery just above the origin of the superior thyroid.

2. *Tracheotomy.*—This has only been done in 2 out of the 1,010 cases.

3. *Lung Complications.*—The large majority of fractures are compound, both into the mouth and outward, and only reach us 2 or 3 days after infliction of the injury, in a very fetid state. The relative rarity of lung complications is therefore striking. Only one rib resection for empyema has been made. For two years the author has been cleaning all jaw injuries with boiled water, avoiding antiseptics as much as possible.

4. *Infections of Adjacent Structures.*—In the series, there was one case of erysipelas, one of maxillary sinusitis, and two quinsies.

5. *Grave Local and General Sepsis.*—One case died of streptococcal septicemia, one of septic meningitis, and one of general pyemia. Two patients died of mediastinitis, which spread from a retropharyngeal abscess in the track of the missile. Of 1,010 cases of jaw and facial injuries there were 27 deaths; of these 7 were beyond saving on their arrival.

REPORT BY CAPTAIN WHALE

At the primary operation, all tissues not hopelessly dead should be conserved. Especially does this apply to:

1. Bone and mucous membrane. Preservation of these structures may obviate the necessity of transplantation in the case of bone and of extensive sliding flaps in the case of mucosa, the loss of viability of either of these never being certain.

2. Parts of the face which are difficult to build up artificially, such as columella or alar margin of the nose. In war injuries we are dealing with inelastic and sometimes avascular cicatricial tissue, less tolerant of repeated interference than normal tissue. In view of this (*a*) provided we have obtained a good vermilion border—if the parts break down, or the cosmetic result is imperfect, it is better to let the lip heal in so far as it will, and later to perform minor operations; (*b*) a destroyed columella usually cannot be reconstructed by the convenient flap from the upper lip, since the wound has as a rule involved this lip also. Having restored the lip, it is unwise to disturb it again; and the columella must be made from the face by the French method, or, better, from a hairless part of the arm or forearm by the Italian method.

Before finally or completely covering in a loss of skin in the region of the jaw, the buccal cavity should have been shut off, by nature's granulations or surgeon's stitches, or both. If this has not occurred, then if the gap be closed by undercutting and sliding adjacent skin, a troublesome salivary fistula results. Such cases may be successfully dealt with by sutures of heavy catgut which embrace the deep structures only and do not reach either the mouth or the skin surface. But if, in order to close such a gap, it has been necessary to swing up a long pedicled flap

from the thoracic wall, the evil results of an unclosed communication with the mouth are much more marked. The distal end of the flap may slough away and, although the proximal part heals, its healing is attended by gross keloid formation, owing to the constant reinfection.

Whoever practices plastic facial work would do well not to adhere implicitly to text-book directions, thus:

1. The time which should elapse between successive steps of surgical procedures can only be ascertained by experiment. In general, it may be said that primary closure of the wound is undertaken too late, and all subsequent stages too early. In particular, pedicles of transplanted flaps can rarely be divided safely after 10 or 14 days, as often stated; three weeks is as a rule a minimum.

2. The margin allowed for shrinkage of flaps is commonly given as 1/6 area. In our experience, 1/3 is more accurate; *i.e.*, a piece of soft tissue should be cut one-third larger than it is ultimately intended to be. It must be remembered that the flap continues to shrink for many weeks, and in all diameters. Thus, a nose made from the frontal tissue shrinks upwards towards its pedicle, so as to be too high on the face; and the piece fashioned for the columella may shrink until it is not long enough to reach the lip.

In making a nose from a forehead flap containing a previously implanted rib cartilage, it is debatable whether the latter should be grafted superficial or deep to the periosteum.

For building up smaller gaps in the nasal bridge after subtotal loss of the nose, it is useful to swing up a vertical strip from the cut anterior edge of the cartilaginous septum. This strip remains attached to the septum at its upper end. The later stages of fashioning a nose by the Indian (forehead flap) method involve reducing its thickness between the eyes, and creating the natural depression just above each ala. Such effects may be produced by excising pieces of skin in a wedge shape, so that on suturing with horsehair (a mattress suture is useful) the area is inverted. The superficial aspect of the excised piece is elliptical, and the depression produced is most marked at the widest part of the ellipse, gradually fading away toward its ends. By varying the relative length and width of the ellipse, and the slope of its edges, any sort of dimple, valley, or crease may be created.

After a wound in the region of the mandible, or at any stage of its surgical correction, an elevation or depression of one angle of the mouth is a frequent occurrence. When this is due to cicatricial contraction there is no special point to emphasize here. But there are two causes for such asymetry which call for remark:

1. Sometimes, after an extensive comminuted fracture of the lower jaw, with more or less loss of bone, it is impossible to maintain accurate apposition of the fragments, by any form of splint, and these fragments are often sufficiently viable to form callus, but will not tolerate wiring. There will be a dip in the level of the jaw on one side, dragging the angle of the mouth down with it. In such cases some form of bridge to raise the level of the depressed part is advisable, and on this bridge a denture is constructed. The angle of the mouth is now brought up by operation. It will often be noticed that the mouth may have eventually a false relation to the jaw on that side, but the dental occlusion nevertheless is perfect, and the mouth straight. This is a better plan than to try to raise jaw and mouth together.

2. Destruction by an external wound of the facial nerve in the parotid region. A completely successful result from anastomosis of the nerve with one of its neighbors is rare. Here again, it is better to lift the mouth angle by a plastic operation. The mouth in repose is then absolutely straight, and the patient's only obvious disability is a whimsically crooked smile.

ANKYLOSIS, TRISMUS, ETC.

1. Herpin, A. A Simple Jaw Stretcher. *Presse Medicale*, May 8, 1916.

The apparatus depicted in the illustration is made of two pieces of hard wood, 30 cm. in length, fastened together by means of a simple hinge, which permits of an opening of the jaws of the instrument to an extent of 5 cm. The handles serve as levers and throughout half of their length beginning at the hinge, have a series of notches cut in them. These notches accommodate rings of rubber which regulate the opening of the jaws of the instrument, more or less great and energetic, according to the distance of application of the elastic traction from the hinge. The jaws of the instrument on their internal and external surfaces are covered with a plate of German

silver, and on this is stamped a semicircular ridge, in order to allow the retention of the stretcher between the teeth of the two jaws.

With this apparatus, traction can be varied according to need; the number of rubber rings can be augmented. But in most cases one is sufficient, with two sittings of a quarter of an hour each, one in the morning, the other in the afternoon, to serve in most cases, with an instrument the extreme simplicity and easy construction of which puts it within the reach of all.

2. Imbert and Real. Constriction of the Jaws Following War Wounds. *Presse Medicale*, 1916, also *Ann. di Odont.*, 1916, i, 341.

Constriction seldom or never follows gross traumatisms. It only succeeds small wounds whose healing has been rapid and which have not altered seriously the skeleton of the face. The writers have never seen true ankylosis of the mandibular joint after a wound. Only 10 to 20 per cent of cases of constriction of the jaws are due to cicatrices. Four-fifths of the cases belong to a form quite different and generally easily curable.

Characteristics.—(1) Is produced from the instant the wound is received. (2) Follows an insignificant lesion. (3) The opening of the mouth is easily accomplished. It is brought about by a mouth opener with two divergent branches, opening by bringing the handles together. It is introduced closed between the teeth and opened with a moderate but sustained pressure. During the opening the patient is made to talk, if possible, by asking him questions. The opening ordinarily is not painful. After the first treatment, there are two daily seances of half an hour each with the automatic mouth opener. Between treatments the mouth is kept open with wood blocks between the teeth. A cure is obtained in two or three weeks. The lesion is probably a simple contracture of the muscles of mastication (myotonia).

3. Kreuscher, P. H. Ankylosis of the Jaw; a report of 23 cases from the clinic of the late John B. Murphy. *Interstate, M. J.*, St. Louis, 1916, xxiii, 857.

The four types of jaw ankylosis are:

1. Intra-articular bony ankylosis, true ankylosis.
2. Intra-articular fibrous ankylosis.
3. Subzygomatic cicatricial fixations.
4. Interalveolar buccal fixations.

Murphy's method of treatment is interposition of foreign material to make the joint.

Four cases of ankylosis:

1. Most frequently, extension of suppuration from middle ear.
2. Osteitis or osteomyelitis of mandible extending into glenoid cavity.
3. Metastases from foci of infection in mouth, or elsewhere in body or part of a metastatic arthritis.
4. Transmitted trauma from tip of chin to articulation, giving traumatic fibrous arthritis.

Diagnostic points in osseous or firm fibrous union are:

1. Flattening of jaw on unaffected side.
2. When patient attempts to open mouth the teeth will move from 1-60 to 1-600 inches downward, and deviate a little toward the ankylosed side.
3. Sliding motion on unaffected side can be felt by palpating finger, and muscular activity on that side is much greater.
4. Muscles on ankylosed side are more atrophied than on other side.
5. Distance by measurement from lower edge of zygomatic arch to lowest point on ramus of jaw is less on affected side.

Vertical incision made just in front of ear extending from 1½ inch above zygoma in hair line downward to lower border of zygoma. This incision then curves forward on superior margin of zygoma for about ¾ inch and then curves upward slightly so as to avoid injuring temporal and orbicular branches of facial nerve. This is followed by removal of section of bone ½ inch wide clear across neck of mandible. Great care exercised not to injure internal maxillary artery, which closely hugs neck of mandible. Injury to brain must also be avoided. U-shaped flap of fascia and fat, about 1-inch wide and 2-inches long, with base at upper margin of zygoma, is reflected from over temporal muscle, and packed into bony gap left by bone resection. Flap retained in position by few catgut sutures at its anterior and posterior basal

angles. Skin wound is accurately closed with horsehair, dusted with bismuth subiodide, and sealed with collodion on gauze or cotton. Wooden wedge is inserted on diseased side to maintain separation of molar teeth to prevent necrosis or compression of flap until it is healed.

Any hemotoma must be aspirated at its first evidence, aspiration being repeated if necessary.

The only failures were reoperated upon with good results. Failures caused, most likely, by not keeping interdental wedge in proper position.

Possibly not all periosteum removed with bone, or the intervening flap may have absorbed.

CARTILAGINOUS AND BONE GRAFTS

1. Cavalié. Treatment of Pseudarthrosis of the Inferior Maxilla. *Bull. et mem. Soc. Med. et chir. de Bordeaux*, 1917, 93-96.

The method consists of an autograft taken from the same region where the graft presents the same biologic qualities as the fractured fragments; the same texture, identical bone and periosteal cells, the same vascular disposition of the capillary vessels in the periosteum, in the compact tissue, and in the spongy tissue.

The principle consists in having a graft long enough for its extremities to be in direct contact with the spongy substance and the periosteum of the two fragments. The junction in particular of the spongy substance of the graft with the spongy substance of each of the two fragments permits very rapidly the vascular anastomoses which prevent necrosis and which precede the work of ossification. It is thus that the maximum chances of success for fusion and consolidation are achieved. It is necessary besides to obtain a consolidation in good position, *i. e.*, the harmonious re-establishment of the inferior arch in relation to the upper arch, which will allow the natural or artificial teeth to occlude normally in mastication.

Details of the method:

1. Opening through the skin at the seat of fracture.

2. Baring of the end of each of the fragments without touching the periosteum, over an extent necessary for removal of grafts.

3. Clearing of the seat of fracture, taking care not to open the buccal cavity, which may provoke suppuration.

4. Freshening with the rongeur the two surfaces of the fracture.

5. Cutting of grafts from one or both external tables of the fragments.

(*a*) If the bony breach is less than 2 or 3 cm., it suffices generally to have only one graft which can be cut long enough from one fragment.

(*b*) If the bony gap is over 2 or 3 cm. wide it may be necessary to cut the graft from each fragment and to unite them in the middle of the breach.

6. Method of cutting the graft.

The graft is detached by cutting with shears the lower bridge of union with the inner table (on the horizontal ramus, for example). Then a flat narrow chisel is passed in the spongy tissue for separation; finally if necessary the extreme limit of the graft on the external table is cut with chisel and mallet.

(*a*) In the process of sliding, it suffices to slide the graft in such a manner that one of its extremities penetrates between the two tables into the spongy tissue of the opposite fragment, whilst its other extremity rests in contact, by its deep spongy surface, with the substance of the fragment of origin. It is at times possible to execute a torsion of this graft on its fragment of origin, leaving it some periosteal adherence in more of the spongy contact.

(*b*) In the process of reversing, the graft is reversed on the fractured end as a hinge, and the spongy substance of the graft is found facing externally. The free end of the graft must enter fully into the spongy tissue of the opposite fragment.

7. Deep reunion by catgut sutures, and cutaneous suture.

A certain number of indications are to be observed:

(i) Operate only in the absence of any inflammatory or pathological condition in the region.

(ii) If a communication with the mouth exists, await healing and removal of alveolar and dental or metallic fragments which hinder it.

(iii) It is indispensable that as perfect immobilization as possible be assured. This immobilization, which is the *sine qua non* of success, should be conceived, and executed minutely by the aid of apparatus which differ according to the position of the fragments.

In general, it is necessary to previously reduce the fragments into good position and hold them by apparatus, and to soften the neighboring tissues by massage.

A few hours after operation, the immobilization is reinforced by the close union of the inferior maxilla to the superior by wiring together two pieces of apparatus applied to the upper and lower dentures.

2. Imbert, L., Lheureux, C. and Rouslacrox. Researches on Heteroplastic Cartilaginous Grafts. *Rev., de chir.*, 1916, li, 111.

Examination, after a long interval, of those operated on showed a tendency to rapid softening of the graft. The graft quickly effected adhesions which enabled it to live; but, as the same time, it gradually became transformed into fibrous tissue. The authors deduce from these experiences, that auto or homo grafts can, equally, in certain circumstances, undergo a more or less complete degeneration.

3. Imbert, L., and Real, P. Surgical Treatment of Pseudarthroses of the Inferior Maxillary. *Marseille med.*, 1916, liii, 193-210.

Surgical treatment of pseudarthrosis comprises two principal methods. The first is applicable to fractures with loss of substance equal to two molars (3 cm.) at most—simple *osteosynthesis*. The other can be employed where the breach is greater —*bone grafting*.

TECHNIQUE OF OSTEOSYNTHESIS

Choice of Anesthesia.—The authors prefer general anesthesia with chloroform as having less danger of soiling the operative field with saliva than in the case of ether.

A curved incision is made with concavity upward. For lateral fractures the two ends of the incision are found respectively at the symphysis and at the angle of the jaw. Nearly always this region presents cicatrices to which it is well to pay attention. If the curve of the incision is subtended by a cicatricial line, it is to be expected that the flap will be exposed to sloughing.

The curved incision gives a flap comprising the skin, the subcutaneous cellular tissue and the platysma. In lifting it up, the facial and also a number of small arteries are cut. Traction is made on the flap with a suspensory thread.

The finger exploring the bottom of the wound easily finds the bony extremities. Denudation is aided by means of a bistoury carried as far as the bone, following a line corresponding to its inferior border. Denudation continues with the aid of Faraboeuf's dissector. We commence habitually with the posterior fragment, whose denudation is easy and less exposed to opening the buccal cavity. The dissector works first on the external surface in the direction of the alveolar border and of the ascending ramus. Then it easily exposes the inferior border. The denudation of the extremity is a little more difficult, because of irregularities. Dissection of the deep surface completes the work. All of the posterior extremity is thus well uncovered; one recognizes habitually then that the inferior border has taken a quite oblique direction, often nearly vertical, to such an extent that it is this border that is to be freshened for approximation with the anterior fragment. The dissection of the latter is nearly always appreciably more difficult; that is owing no doubt to its muscular insertions; the dissector follows its contours with difficulty, especially on the external surface and on the end. The internal surface is more easily freed. However this may be, it is necessary that this fragment also should be well liberated. Great care must be taken to keep out of the mouth.

The mass of fibrous tissue between the fragments is now to be excised with scissors, above all the deeper parts. The edges of the fragments are squared and freshened with a bur in the electric engine. See that the fragments come into close contact; if necessary they are brought together by wire passed through holes bored near the ends. A metallic plate is fastened to the ends by screws employed for fixation. It is made of more or less malleable metal (German silver). In putting in the screws, avoid the roots of the teeth. Keep as near as possible to the lower border of the jaw. Two screws for each fragment. Teeth are fixed in occlusion with brass ligatures, maintained for two months at least.

Bone Grafts.—These are only indicated on old cases of pseudarthrosis since the great majority of recent fractures consolidate without difficulty. Aside from cases

of great loss of substance, the bone grafting operation should always have been preceded by a prolonged prostbetic treatment whose inefficacity shall have been well demonstrated.

4. Morestin, H. Cartilaginous Transplants in Reparative Surgery. *Bull. et mem. de la Soc. de Chir. de Paris*, 1915, xli, 1994.

Cartilages of the 6th, 7th and 8tb ribs, are the only ones that can easily be made use of. Resection of any of these cartilages never brings about any untoward consequences, if attention is given, and if one reconstitutes with care, by layers of sutures, the musculo-aponeurotic bed. Even after having entirely removed the three cartilages mentioned, I have never observed any accident or inconvenience whatever, and in particular neither lasting respiratory trouble, nor difficulty on exertion, tendency to hernia, nor pain.

Costal cartilage easily lends itself to be cut with a knife. Sheets, rods, arcs, etc., can be cut, and fashioned in the form for adaptation to their destination with extreme precision. The surgeon has no need, in preparing his piece of prosthesis, either of help or special instruments.

Along with this property of adaptation, cartilage offers very great resistance and will take everywhere the place of bony tissue.

The transplanted fragments are really grafted, they live their normal life, they adapt themselves with extreme rapidity to their new conditions of existence, and this graft succeeds always, so to speak, whilst that of bone is so difficult to obtain. The grafted cartilage lives indefinitely, without being resorbed, without undergoing appreciable diminution. The importance of this may be conceived. The result is that, in practice, one has not to consider reduction in size of the transplanted pieces, and one can and should give them their exact dimensions.

Cartilage may be taken from another person, and may have been removed as long as a month previously to using as a graft. Operations can often be done under local anesthesia. The cartilage frequently remains slightly mobile on the bone, but is adherent to the soft parts. After removing the costal cartilage, it is necessary sometimes to ligate the internal mammary artery. After this, the muscular bed, the superficial aponeurosis and the skin are sutured.

In placing the cartilage, the bony surfaces of the wound must be as free as possible of oozing of blood. The different pieces of cartilage should be applied to one another with flat surfaces. If bleeding persists drainage must be provided for temporarily, by leaving an opening in the skin wound which is usually closed after twenty-four hours. As a rule the cartilage is retained in place by being cut to fit accurately and needs no other retention.

Even infection of the operative field does not necessarily mean elimination of the cartilage, and it suffices to prevent its loss, to reopen the wound, evacuate the pus, and maintain drainage.

The graft does not always suffice to assure definitely the fixity of the jaw. As one cannot unite the cartilaginous tissue to the bony tissue, all that one can hope for is, by the interposition of the transplanted pieces, to fill the interval between the osseous fragments, and to place an obstacle in the way of reproduction of vicious position and very often there exists between the extremities of the bone and the cartilaginous block, a very close pseudarthrosis. In the latter case, the persistence of a slight, obscure mobility does not cause noteworthy interference with the function of the jaw. Improvements in technique will no doubt bring about still better results.

By doing the operation under local anesthesia, the patient can be made to avoid all inopportune motion, the fouling of the wound from emission of saliva.

Above all, the technique can be improved by bringing about better fixation of the parts. The transplants should be adapted in most minute fashion to the loss of substance. They should be made with extensions passing within and without the bony fragments. It would be good practice to fix them with ligatures and sutures.

The jaws should be fixed at the time of and after the operations by means of mechanical appliances and by external apparatus, the latter for at least a few days.

5. Morestin, H. Cartilaginous Transplants in the Repair of Defects of the Lower Jaw. *Bull. et Mem. de la Soc. de Chir. de Paris*, 1915, xli, 2418.

After removal of the graft formed of the 6th and 7th costal cartilages of the *same side*, raised up in a single piece, I stop the general anesthesia completely, and the facial stage in spite of its complexity, is accomplished entirely under local an-

esthesia with cocain. This method of procedure offers enormous advantages. Most of the dangers of infection are done away with, one is not bothered by the presence of the anesthetist, finally the maneuvers are more conveniently carried out with the patient conscious.

For the operative incision, I am guided by the disposition of scars, and limit myself simply to their excision; the wound which results from their extirpation is enlarged if necessary, its direction is of little importance. I seek then the extremities of the bony fragments, uncover and free them. I measure their distance apart, and then trim the graft, giving it the proper size.

The posterior extremity of the 6th cartilage will become the ascending ramus, that of the 7th will form the angle of the jaw, the two cartilages placed together and fused will constitute the horizontal arch. In order that the angle shall attain the required prominence, and the horizontal arch have a more normal appearance, it is necessary to take the cartilages from the same side as the injured jaw. I take care to trim the anterior part of the graft to a thin bevel at the expense of the internal surface. This thinned extremity must exceed the limit of the breach to be filled, in order that it can be bent back inwardly and applied on the anterior fragment.

To facilitate its incurvation and adaptation, I make several incisions in the piece itself which prolongs the graft, taking care never to interrupt completely the continuity of the perichondrium. Finally, the permanent form can be given to the graft after having installed it in the wound, where its final trimming is done.

METHODS OF FIXING THE CARTILAGINOUS PIECE

At first it is necessary to prepare, between the soft parts and the debris of the jaw, places where the ends of the graft can be lodged. Behind, it is relatively easy; between the masseter, on one side, and on the other the internal pterygoid and what remains of the ascending ramus, a deep excavation is made which will receive the posterior end of the 6th cartilage, to become the new ascending ramus.

In front, it is necessary also to dig out a cavity of reception; the most simple is to turn back the periosteum of the anterior fragment on its external surface, forcing back at the same time all the soft parts.

The end, tapered and prepared as said above, is forced into this lodging. Already the prosthetic piece begins to find a certain fixity. In my last operations I have been solidifying the graft immediately with the surrounding soft parts by suturing them. A strong needle is required to pass without difficulty through the cartilage; the masseter, brought over the external surface of the prosthetic piece, spread and drawn down as much as possible, is fastened to this piece by a series of catgut sutures. The stretched muscle draws the graft upward, and contributes to keeping it very solidly in good position. In all the compass of the piece, above all where one can find a hold on the muscular or fibrous tissue, sutures of catgut are placed. The same is done in front, where the end of the graft is sewn to the soft parts of the region of the chin which are fairly resistant. Thanks to this system of sutures, with multiple threads passed without hesitation in the thickness of the cartilaginous tissue, the piece finds itself fixed in the position desired by the surgeon. Nothing remains but to hermetically close the superficial wound.

It is understood that the operation has been prepared by complete reduction of the vicious attitude of the jaw, that for a long time necessary precautions have been taken to reëstablish the articulation of the teeth on the healthy side if one has not been able to treat the patient shortly after his wound which would have allowed prevention of the displacement.

Apparatus for maintaining immobility of the jaws during and after operation: latch or bolt apparatus.

This consists of two fixed pieces inserted before the operation, cemented one to the upper teeth the other to the lower, on the healthy side, and provided with a bolt to unite them. The fixed pieces are composed of a series of bands embracing the crowns of the teeth, leaving free the occlusal surfaces. Each of the pieces carries on its outer surface a flattened gutter 2 cm long. These gutters are placed to correspond very exactly, that which is attached to the upper piece is placed exactly behind the one on the lower piece; the anterior extremity of the first is in contact with the posterior extremity of the second. They have the same direction, the same axis. The two jaws being brought together, they form a common canal. This canal engages the bolt. The latter is flattened, ending in front in a somewhat larger extremity. It slides with friction in the two grooves which it fills very exactly.

This system of grooves and bolt is lodged in the buccal vestibule, and the anterior end of the bolt comes opposite the labial commissure.

In spite of its lightness, this apparatus has very great solidity. It is of German silver, and sealed to the teeth with cement. Once the bolt is in place, the two jaws are attached to one another in an absolutely invariable manner. The jaws can be readily opened by withdrawing the bolt, necessary sometimes in accidents in the course of the operation or afterward.

The fixed pieces are cemented before the operation, perfect adaptation between the upper arch and what remains of the lower having been previously obtained, if necessary after section of the callus.

It is necessary that at the time of placing the graft there be no effort made to obtain reduction, nor above all no violent maneuver at the site of fracture, which would lead to communication with the mouth and would render useless the attempt at transplantation.

During the removal of the cartilages, the patient being asleep under chloroform the bolt is withdrawn, the jaws can be opened, the anesthetist is quite at liberty to sponge away mucus, to seize the tongue if necessary. When it comes to the second stage, executed under local anesthesia, the bolt is pushed back and immobility of the jaws is obtained; this state of affairs is left for several weeks.

6. Woodroffe, H. L. W. *Brit. Jour. Surg.*, July, 1917. Reparation of Cranial Defects by Means of Cartilaginous Grafts.

Technique of Cutting Cartilaginous Grafts.—The grafts are taken from the 6th, 7th and 8th costal cartilages, for convenience from the same side as the head wound. The usual incisions are parallel to and a little above the costal margin. A vertical one, two fingers breadths outside the edge of the sternum, however, is preferable. It gives equally good access; can be more easily extended if necessary; hemorrhage is less; the upper fibers of the rectus are split instead of cut. The cartilages having been exposed, shavings are taken of about half their thickness. Care should be taken not to cut through the entire thickness of a fixed cartilage. But the whole tip of a floating one may be taken. It is well to take what seems to be considerably more than enough cartilage to fill the gap. Each graft as cut, is dropped into warm saline solution. To facilitate this work at the bottom of a hole, M. Vilandre has devised an ingenious knife, the blade of which is set on a shank bayonet or trowel wise. This enables the grafts to be cut evenly by keeping the blade of the knife flat.

(*To be continued.*)

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BOOK REVIEWS

COLLECTED PAPERS OF THE MAYO CLINIC. Vol. viii, 1916, Rochester, Minn. Philadelphia and London: W. B. Saunders Company.

Swift in his essay, "A Tale of a Tub," says, "I have sometimes heard of an Iliad in a nutshell; but it has been my fortune to have much oftener seen a nutshell in an Iliad. There is no doubt that human life has received most wonderful advantages from both, but to which of the two the world is chiefly indebted I shall leave among the curious as a problem worthy of their utmost inquiry." Although it is proposed to leave to the readers of Volume viii, Mayo Clinics, to pick the nutshells from this Iliad of forty-two authors, it must be acknowledged that there are some exceptional nutshells; it must also be acknowledged that in book-making Swift found human nature the same two and one-quarter centuries ago as we do today.

After this digression the writer desires to state that, taken as a whole, more real knowledge of practical value can be gotten out of a comparative study of the Mayo Clinic volumes from year to year in the particular subjects in which they justly are considered authoritative than in any other books with which he is familiar. Since the addition of Rosenow to the Clinic force, a strengthening up of the teachings of science as applied to medicine and surgery is very apparent. The work is more scientific—less technico-statistical. Rosenow's study in "Elective Localization of the Streptococcus" and other organisms is almost epochmaking in its importance, as it is evidently one of the entering wedges in solving the causation, prevention, and successful treatment of probably many diseases, both medical and surgical. A happy clinical demonstration of this has recently been carried out by Rosenow himself, in the successful treatment of little sufferers from endemic anterior poliomyelitis in Davenport, Iowa.

W. J. and C. H. Mayo have papers upon surgery of the large intestine which are instructive, and W. J. Mayo's paper, "The Removal of Stones from the Kidney," is beautifully and accurately illustrated, and, with the text, one who has seen and heard the doctor at this work can almost feel that he is again at the clinic.

Judd describes a way of doing a cholecystectomy which lessens the ever-present danger of wounding the common duct, and Balfour describes his technic of splenectomy, the adoption of which, by all of the operators of the Clinic who do this work, has made possible the remarkable series of splenectomies done at Rochester and allowed of a comparative study of their value in the "Maladies in which Splenectomy May be Indicated."

MacCarthy and Broders call attention to "The Actual Error in the Diagnosis of Mammary Conditions." It will surprise most surgeons to be told and have proven to them how weak they are in differentiating the malignant from the benign tumors of the breast in other than the typically malignant. The authors show that, basing their studies upon an analysis of 1,800 mammary pathological conditions from the comparative standpoint of clinical and pathological diagnosis, there is made, first, an *actual* error of from 2 to 26 per cent;

second, an *apparent* error of from 8 to 50 per cent; and third, an *avoidable* error of from 1 to 86 per cent. The careful reading of this article will repay any surgeon and it is certainly a "nutshell."

Dr. A. B. Moore has a short but fine paper, "Roentgen Diagnosis of Bronchiectasis," which, independent of several illustrations, X-ray pictures of types of bronchiectasis, has a clear and instructive clinical description of the disease, one of the best we have seen. Following this paper is one on "The Surgery of Bronchiectasis," by Samuel Robinson, a fair, judicious paper, warning against surgery as a panacea in this and other diseases of the chest, and on the other hand calling attention to the ever-positive failure of medical treatment in as many instances. Robinson reports five complete resections of the lower lobe of the lung for bronchiectasis, with one death—20 per cent.

"Tumors of the Spinal Cord, with Report of Eighteen Cases," by the late Dr. Beekman, is the most modest, but withal *the* paper showing the highest individual diagnostic and operative skill of any in the volume. Beekman, with his thoroughness, gentleness and manual skill, was one of the safest operators we have ever seen, and it will be years before the Clinic can train his equal.

Henderson's papers on "Mechanical Derangements of the Knee-joint," and "Loose Bodies in the Knee-joint," are faithful descriptions of these conditions. A number of other good papers might be noted did space permit, but they are mostly upon subjects about which the profession has been well informed in many previous papers from this and other sources.

The final pages of the book on "Technique" and some general subjects, except for articles by C. H. Mayo and Balfour, to which reference has been made, contain nothing worthy of special mention.

JNO. E. SUMMERS.

IMPOTENCE AND STERILITY WITH ALTERATIONS OF THE SEXUAL FUNCTION AND SEX-GLAND IMPLANTATION, by G. Frank Lydston, M.D., D.C.L., Formerly Professor of the Surgical Diseases of the Genito-Urinary Organs and Syphilology in the Medical Department of the State University of Illinois, etc. Chicago: The Riverton Press, 1917. Price, $4.

This unreasonably high-priced book is apparently written by a man with a grievance. The author evidently believes that the medical press has not given him due credit for original work and the book is published in order that his hormone theory of aberrations of sex development and function and his researches and observations in the field of sex-gland implantation may be presented in permanent form.

Nearly half the book is taken up by the chapter on sex-gland implantation. This is interesting reading and shows painstaking research, but the number and results of the experiments do not warrant the sweeping conclusions arrived at by the author. They remind the reviewer of the advertisements of the justly infamous "remedies" sold as cure-alls at the Indian shows so popular a generation ago.

His hormone theory of aberrations of sex development and function would, if proven to be correct, explain much that is now beclouded. However, the theory is still in a nebulous stage.

His discussion of the diseases of the sex function is clear and practical, but the value of the work as a manual is impaired by the undue prominence given his saddle-galled hobbies. FRANCIS M. MUNSON.

NOTES FOR ARMY MEDICAL OFFICERS. Medical War Manual No. 2. By T. H. Goodwin, Acting Colonel, Army Medical Service. Author of "Notes for Medical Officers on Field Service in India" and "Field Service Notes for R.A.M.C." Introductory note by Surgeon-General W. C. Gorgas, U. S. Army. Philadelphia and New York: Lea and Febiger, 1917. Price, $1.

This valuable little manual is the outcome of a series of lectures delivered by Colonel Goodwin to the classes of the Army Medical School. They are founded upon the experience of this distinguished officer in actual warfare on the Western Front. The solutions of many of the problems confronted by our Medical Corps are found in this book. It will be a valuable assistance to the young medical officers now going abroad for active duty.

The first section deals with the organization and administration of the British Army with special reference to the medical services, duties of the medical officer in charge of a battalion, the regimental aid post, the field ambulance, motor ambulance convoys, casualty clearing stations, stationary and general hospitals.

The second section is a brief résumé of the present status of war surgery. Sir Almroth Wright's and the Carrel-Dakin methods of wound treatment are outlined and the latter very properly approved as the method of choice. Gas poisoning and the principles of its treatment are mentioned.

Military sanitation, including the sanitary organization of units in the field, is well presented in a concise manner.

American medical officers are fortunate in having these timely notes at their disposal. FRANCIS M. MUNSON.

A TREATISE ON REGIONAL SURGERY, by various authors. Edited by John Fairbairn Binnie, A.M., C.M., F.A.C.S. Three volumes with 351 illustrations. Philadelphia: P. Blakiston's Son and Company. Price, $7.00.

This work presents short treatises on the injuries and diseases of the different regions of the body. Volume i deals with the head, branchial system, the thorax and the breast; Volume ii, the abdomen, the genito-urinary system and the spine; Volume iii, in print, the upper extremity and the lower extremity, together with a section on the thoracic walls, lungs and pleurae.

The individual authors were carefully selected. Each treatise is brief, the contents highly practicable and consisting of the opinions of the author himself and not a statement of what "he thought other people would think that he ought to think." The work shows forcibly the particular operations advocated. The respective operative procedures are well illustrated, bringing out clearly the applied surgical anatomy where possible.

The scheme underlying and responsible for the world-wide popularity of Binnie's "Operative Surgery," appearing in a seventh edition in 1916, has been followed in the present work, namely, avoiding the perspective of the usual text-books on general surgery, with sound judgment in selecting and clear statement in describing the operation of choice for the various surgical procedures. H. F. STRINE.

NOTES AFIELD

OBSERVATIONS OF THE MEDICO-MILITARY ORGANIZATION OF THE ITALIAN ARMIES

By A Military Observer

1. AFTER having presented our credentials to the American Consul at ———, we proceeded to ———, the headquarters of the armies operating at the eastern Italian frontier. There our papers were given the final examination, and each one of us was presented with a document properly signed and stamped, which gave us permission to visit all the Italian frontiers, with especial emphasis laid upon the sanitary organizations. A competent Italian medical officer who spoke English was ordered to escort us on our tour of inspection, and two powerful army automobiles with chauffeurs and mechanicians were given over for our exclusive use during our stay in Italy. The program for each day was laid out the night before by our escort, the medical officer, assisted by other medical officers. The scheme was systematic, thorough and efficient, and no time was lost in executing the plans.

2. In a previous report, dated November 4, 1917, the general scheme of the Military Sanitary Service in Italy has been pointed out, resembling, to a great extent, our own and that of our English and French Allies. It has also been pointed out that they have found it advisable to have a highly specialized hospital service. The Italians probably have carried the idea of specialization in war surgery and war medical service farther than any other nation. The efficiency and economy of such methods cannot be too much emphasized. We found special hospitals for typhoid, for fractures, for brain and nerve surgery, plastic surgery, venereal diseases, etc. Further, the advantages the Italians have in the use of villas, hotels, and private buildings for base hospitals, field hospitals, and even advanced dressing stations were shown.

3. We learned at ——— that the Italians are especially careful on the subject of preventive medicine, and this has brought remarkably good results. Immediately after having been wounded, the Italian soldiers are given anti-tetanus serum, which treatment is repeated within eight days. Dr. Levy, of the British Red Cross service, now stationed in ———, informed us that during one year of service at the Italian front he had not observed a single case of tetanus. Gangrene bacillus infections are of comparatively rare occurrence. It is a rule that every case in the Italian hospitals should have a careful examination of the feces for at least six consecutive days, no matter what the particular

ailment is, before being sent to the interior uninfected zones. This is for the purpose of determining any possibility of typhoid, cholera, or dysentery, which are the bugbears of the Italian doctors. The typhoid cases, as has already been pointed out, are remarkably few and are cared for in special hospitals. There is a universal prophylactic administration of combined typhoid and paratyphoid vaccine, as well as vaccination against smallpox. In August, 1916, after one of the great battles in the Isonzo Valley, there was a severe outbreak of the cholera, which resulted in as many as a hundred thousand cases. Through an exceedingly careful system of prophylaxis this dreaded disease was confined to the advanced war zone, and not one case ever developed outside that territory. The cholera always originated in the Austrian trenches. At present all soldiers who go into active service at the front receive a cholera prophylactic. This has resulted in a total absence of cholera at the present time.

4. Inquiring into the question of shell shock we learned that this is a comparatively rare thing in Italy. Some of the medical men, especially Dr. Levy, who have observed the medical work at the Western and Italian fronts for long periods of time, seem to think that the extraordinary good health of the Italian soldier and the careful selection of the fighting man have a great deal to do with his superior general health, consequently his more stable nervous system.

5. In ——, we visited a large base hospital with 1,250 beds—the ———— ————. Inquiring into the Dakin-Carrel treatment, we learned that it was not the popular treatment in Italian hospitals. Their method in the treatment of infected wounds was to open wide and drain with dry drains or rubber tubes. There seemed to be fewer cases of infected wounds in Italy than elsewhere. This probably is due to the fighting in the mountainous regions on a comparatively clean soil. They point with pride to their records, which show equally good results to those shown in hospitals where the Dakin-Carrel solution was used. The compound fractures were treated until the infection ceased; the patient was then etherized and the fracture reduced into position and held by simple apparatus for extension. No overhead extensions were employed; a special cardboard was used to make splints, which seemed very practical. The cardboard is cut into proper shape, moistened in water and applied. It would conform very smoothly about the part to be supported, harden within two hours, and seemed to be an excellent splint. There were large, commodious dressing rooms, while the operating rooms were smaller but scrupulously clean.

6. There have been established special hospitals for the treatment of brain, cord, and nerve injuries. One is located in the war zone, one in

the central part of Italy, and one, which we had the pleasure of visiting, at ———. This hospital was extremely well organized and equipped. It had an electrotherapeutic department, where Faradization was extensively used in the treatment of paralysis. Some especially interesting cases of paralysis of the branches of the brachial plexus were demonstrated and their progress noted. There was an ingenious method employed in the diagnosis and record keeping of these cases by means of specially designed and printed record sheets. These sheets were printed to represent the whole body, or special parts. By means of a color scheme it was recorded what parts were affected—whether the deep or the superficial muscles, the sensory or motor nerves, and the areas involved; also the degree or the intensity of the affection. By a glance at the chart one could tell exactly the condition of the patient at the time of admittance, his progress and condition at the present time, which all saved lengthy descriptions.

A well-equipped radiographic department was installed, and we had the pleasure of observing some good work in radiography. There was especially an apparatus known as "Radiostereometre Baese," used for locating foreign bodies. The examination was quickly made by aid of a fluoroscope, by simple measuring methods and pointers. Without any compasses and with but little calculation a foreign body could be located in a short period of time. The surgical work performed in this hospital was very good. We had the good fortune of witnessing some cranio-plastic work by Professor Righetti, when he performed his specially modified flap operation. As a general rule the brain decompression was performed after twenty days and the cranio-plastic work done at any convenient time following, when the patient was out of danger. The cases demonstrated showed excellent results. We also had the privilege of witnessing some nerve surgery.

7. At ——— we visited another special hospital, for oral surgery—the ——— ———, where Prof. Perno Ar[illegible]dero is the surgeon in charge. His work and his hospital organization were both very good. At the time of our visit there were 150 cases in the hospital, every one a mouth or jaw case. There was a large dental workshop in connection with the hospital, where a number of dentists and their assistants were at work. Plaster models were demonstrated, as well as photographs showing a complete record of each case from the time of entrance to the hospital, the steps of the operations, and final results. The X-ray work was good, and here as in many other hospitals the direct method was used; that is, the exposure was made directly on paper instead of plates, which was then developed, appearing as an ordinary photograph taken from a plate. Since the beginning of the Italian campaign 4,000 cases had been

treated here. A number of cases were demonstrated, and we were especially impressed by the fact that none of them had any escape of saliva from the mouth, a very common feature noticed elsewhere following oral surgery. The success in the restoration of badly mutilated faces seemed truly remarkable.

8. A visit was made to Ospodale ———— ————, located to the east of ——— in the war zone. This was the largest base hospital we visited, having accommodations for 4,000 patients. The hospital buildings had in former times been a cavalry school, but now were nicely adapted to their new purpose. The buildings covered a very extensive area with a large open space in the center, which had formerly been used for cavalry practice. This was now transformed into a vegetable garden, cared for by convalescent patients. The garden products were largely used by the hospital kitchen. So well trimmed was the garden that the work was evidently supervised by an expert gardener. It is not without interest to note that the Italian government encouraged this form of gardening in connection with every hospital, the economy of which in a country at war must be self-evident. As a result we saw very good looking and productive gardens, and even poultry yards, in connection with every large base hospital. The food quality was remarkably good at all these hospitals.

The hospital was beautifully organized with large, modern and well-equipped laboratories, X-ray department, sterilizing department for patient's clothing, and a special one for re-sterilization and re-preparation of recovered bandages and surgical dressings. The wards were well lighted and scrupulously clean. It was compulsory for each patient when visiting a wash room or toilet to slip on a pair of wooden shoes which were lined up at the entrance to each such station. While a simple practice, this facility for promoting cleanliness must be a great factor in preventing the spread of infection, dirt and moisture throughout the hospital.

In connection with the hospital were several temporary barracks of the chalk-walled variety, which have already been alluded to in the previous report. They were built out of double-plastered walls, were white finished and very attractive one-story structures, measuring 200 by 7 meters. Each barrack included a modern bathroom, two water-closets, pharmacy, and dressing room. The capacity of each was 150 beds, and the cost of construction, $1,800.

The kitchen was large and clean, provided with modern cooking apparatus. A particularly noticeable feature in the food supply room was a special brand of preserved (not condensed) milk. This milk was sterilized and put up in cans and, because of hermetical sealing, would

last for many years. We had the pleasure of tasting it and found it very palatable and free, as claimed, from chemical preservatives. It was a product of Milan, and its value and convenience in a hospital diet cannot be doubted.

This was particularly a surgical hospital, although in times of offensives it would become more of a general type. The operating rooms were well lighted, clean and orderly, and the work performed was of a high class. It was interesting to hear that artificial pneumothorax was much employed here in the early treatment of lung injuries.

9. That the physician's work is not limited to the preventive and curative treatments only was proved by our visit to a salvage plant near ———. This was under the direct supervision of a physician and was one of the several (each army has a salvage plant) in Italy. The work performed was of a wide scope. All sorts of materials used by an army in the field—helmets, stoves, knives, bayonets, guns, tents, blankets, clothing—were found here. This material had all been picked up on the battlefield and brought here for thorough rejuvenation. The greatest care was used in handling the material, a large percentage of which, no doubt, was infected by the germs of deadly diseases. The systematic disinfection, washing, cleaning and repairing were admirably performed. We were shown large stores of reclaimed material which, we were told, saved the government close to $1,000,000 per month. Two-thirds of the number of workers here were women.

10. We visited a clearing station at the terminus of a railway system operating as close as 6 kilometers from the front. After an engagement, sometimes within a very few hours, great numbers of patients are brought here by automobile ambulances. They are then classified and disposed of to the different field hospitals, 15 of which are connected in their work with this clearing station. As many as 6,000 patients could be received and distributed from this institution within twenty-four hours.

11. *Hospital Trains.*—At the outbreak of the war the Italian government had no hospital trains. The Italian Red Cross has 22, and the Malta Cross 4. The government has since constructed 46, making a total of 72 hospital trains now at the disposition of the Italian Sanitary Service. We visited two such trains—one of the Malta Cross and one of the regular army, which are built on the same plan. Each had a capacity of transporting 300 to 350 sick and wounded. The stretchers, which also formed the beds, were well constructed and strong. They were placed in tiers of three, parallel to the car side, leaving a wide passageway through the center of the car. The sickest or most gravely wounded were placed on the lower shelves.

12. An interesting feature in connection with the stretchers was their uniformity of construction. Because of standard size the stretcher on which the wounded or sick soldier was placed on the battlefield accompanied him to the ambulance, to the temporary dressing station, and to the train without necessitating his being moved from his original rest.

13. It is interesting to note that much first-class surgery was performed right in the field hospitals. The following is a report on the surgical service of field hospital No. 83, by the major in charge, from August 16 to September 20, 1917, which I have had translated from the Italian language.

Patients admitted, 893, and classified as follows:

Cranial	68	Abdomen	25
Face	39	Upper extremities	138
Neck	16	Lower extremities	375
Thorax	110	Miscellaneous (slightly wounded)	8
Spine	9		
Shoulders	105	Total	893

Of this total, 685 were transferred to other hospitals, 20 were returned to duty, and 31 died. According to the figures the percentage of mortality was 3.45 per cent. On September 20, 1917, there were 164 wound cases in the hospital.

Of the 68 cranial cases, 52 were operated upon. Sixteen were not operated upon because the lesions were only superficial. Of the 52 cases operated upon, 48 recovered completely and 4 died. Of the 110 thoracic wound cases 5 died, 3 of these following pneumonia, 1 acute anemia and 1 acute anemia and shock. In general the thoracic cases were treated by absolute rest for twenty days, except in cases where special therapi was indicated.

Of the 25 abdominal cases, 18 were treated by rest, diet, morphine or stimulants. Six were operated upon. Eleven of the 25 died, 5 of the number following the operations.

Of the 513 wounded in the upper and lower extremities, 5 died, one of these following acute anemia, 4 after sepsis. These latter 4 were not operated upon because of general bad condition.

All simple fracture cases were transferred to other hospitals. The compound fractures were treated in the hospital by opening and draining, heliotherapy and immobilization. Joint wounds were very few and not serious.

Where indicated radiograms were taken—from August 16 to September 20—80 in all were made.

The treatment of wounds in general was very simple, generally by

opening the destroyed parts and wound edges, excising them and draining with sterile gauze. The wounds were never washed, merely mopped out with dry sponges or gauze. Very often "Vincent's Powder" was employed (boric acid 9 parts, calcium hypochlorite 1 part). The result was very satisfactory. Very rarely, when indicated, the wounds were washed out with peroxide of hydrogen. In nearly all wounds heliotherapy was employed with good success. Antitetanic serum was given in all cases of wounds.

Of the total 895 cases, 95 were operated upon, according to the following division:

Cranial	52	Abdominal	6
Face	1	Upper extremities	6
Neck	3	Lower extremities	19
Thorax	3		—
Shoulders	5	Total	95

Twelve died following the operation, as follows:

Cranial	5	Lower extremities	1
Neck	1		—
Abdominal	5	Total	12

The figures show that the rate of mortality in operative cases was 12.0 per cent.

In all urgent cases operations were performed immediately upon admission or during the same day, with exceptions where such contraindications existed as shock, acute anemia, general peritonitis, or sepsis in advanced form. The wounds were sterilized with pure tincture of iodine. The operator's and the assistants' hands were sterilized by a wash in pure alcohol, plus 2 per cent iodine, for five minutes. The gauze and dressings were sterilized in an autoclave. Only sterile gauze was used, very rarely iodoform gauze.

For anesthesia there were employed morphine and chloroform. In one-third of the number of operations local anesthesia, such as infiltration of stovanin, or freezing by ethyl chloride, was employed. In abdominal and cranial cases general anesthesia was always employed. In the other cases the nature of the operation and the condition of the patient were the governing factors.

Concerning the cranial cases: As a general rule they were all operated upon, except where the surgeon was reasonably sure that the wounds were only superficial. Repeatedly it was found that with very light and seemingly superficial lesions of the scalp there existed underneath large lesions of the skull and the brain. In but six of the 52 cranial cases operated upon were there no deeper lesions. As a general rule the cranial wounds were recent, but there were a few which were several

days to a week old. Radiography was performed before operation in all cranial cases.

In general craniotomies were performed with hammer and chisel. In cases of simple penetration of pieces of bone into the brain, extraction was performed. In cases of large depressions trephining was performed by raising the depressed part; this was also for the purpose of digital explorations and for the purpose of stopping hemorrhage. Through the opening, following trephining, one could make valuable digital explorations and digital extractions of bone particles which could be done by no other means. Projectiles and bullets were always extracted from the brain wherever possible. Only in four cases were found grave lesions of the longitudinal and lateral sinuses. Such wounds were always produced by bone fragments, and when attempts were made to extract these, severe hemorrhages were always observed. When the wounds of the sinuses did not exceed one-half centimeter in size, haemostasis was made by suturing, the Carrel technique being employed, that is, the fine needle and very fine silk. The results of such suturing were always satisfactory. When the surgeon was sure of no infection the wounds were closed and usually healed by first intention. In other cases the wounds were left open with a drain of gauze.

In one-third of the number of cases of cranial injuries, paralysis in some form was present and usually disappeared after the operation. In but few cases there remained the paralysis of the facial nerve, and sometimes strabismus. The results of these operations were very satisfactory, in all but five cases, the patients dying of infection following cephalitis or meningo-cephalitis. In 5 of the 52 cases Jacksonian epilepsy developed some days after the operation. The symptoms disappeared spontaneously or following the administration of bromides. Percentage of mortality following cranial operations, 9.6 per cent.

In the three neck cases there was one with a projectile beneath the pneumogastric nerve, producing symptoms of dyspnea and dysphagia. He recovered from the symptoms following the extraction, but later developed a broncho-pneumonia, from which he also recovered. The second case was one of gas gangrene of the neck muscles. The treatment consisted in dissection and complete separation of all deep, as well as superficial, neck muscles on the right side. The patient got well. The third case had a ligation of the carotid artery performed for the purpose of stopping a severe hemorrhage from the lingual artery. The operation was made rapidly and the hemorrhage stopped; the patient, however, remained in a very bad state of acute anemia. He was given 1,500 cc. of normal saline by the intravenous method, which brought back his pulse. He died, however, in half an hour following the injection, with symptoms of dyspnea and cyanosis, because of the high dilution of the

blood. Percentage of mortality from neck wounds, 33⅓ per cent.

The thorax wounds did not present any special interest. Some rib resections were made and all cases got well.

Abdominal: Six operations performed, of which five were laparotomies and one suprapubic cystotomy. All these patients were in very bad condition. One had a projectile in the pelvis of the left kidney. He got well very rapidly. Three died of general peritonitis, one of acute anemia, following a severe wound of the spleen. This latter case died of acute anemia. One case operated upon for multiple perforation of the small intestine died in four days of myocarditis. The suprapubic case, also having had severe pelvic injuries, died of sepsis. Mortality rate high: 83 per cent.

There were 25 operations performed on extremities, mostly dissections for gas gangrene. All got well. Four amputations were performed for gangrene following very grave wounds of compound fractures and arterial and venous lesions. All recovered. Note very low number of amputations, considering 513 cases of wounds on the extremities. Percentage of amputations, 0.77 per cent.

Seven operations were performed on blood vessels, one on the axillary artery, one on the femoral artery at the origin of the deep femoral, three wounds of the arteries and femoral veins in the region of the tibial and fibular vessels. In all these, ligation of the vessels was performed. Suturing could not be performed because of severe lacerations and contusions, or because of the general condition not permitting long operations. In five cases there were light wounds of the arteries and veins.

14. Near ——— we visited a venereal and syphilitic hospital with about 400 beds. The treatment presented nothing of special interest. We merely wish to acknowledge, again, our satisfaction with the specialization of hospital service.

15. Not far from ——— we visited an interesting and highly instructive museum which is devoted entirely to an exhibition of specimens of war pathology. The collections were housed in a very modest wooden building, the collecting, preparation and classification of specimens being under the direct supervision of Col. Guinia Salvi of the Italian Red Cross. Here we saw a remarkable collection of skulls, demonstrating all forms of fractures and destruction. They were mounted in such a way as to show as nearly as possible the mechanism of the injuries. In the same way was demonstrated every bone of the skeleton. The skill with which the fragments in severe comminutive fractures were wired together deserves great praise. There was also a complete collection of all internal organs, with a clear demonstration of their respective injuries.

INSTRUMENTS AND APPLIANCES

AN IMPROVISED APPARATUS FOR THE PERIODICAL FLUSHING OF WOUNDS WITH A MEASURED QUANTITY OF SOLUTION.[1]

Major Howard Lilienthal, M. R. C., Base Hospital No. 3, has recently devised an automatic appliance for the irrigation of wounds after the Carrel-Dakin method, which he kindly describes for our members, as follows:

Conscientious regularity and care in the flushing of wounds which are under treatment by the Carrel method is absolutely essential to success. By night, as well as by day, every two hours, a measured quantity of the Dakin's fluid must moisten the infected surfaces.

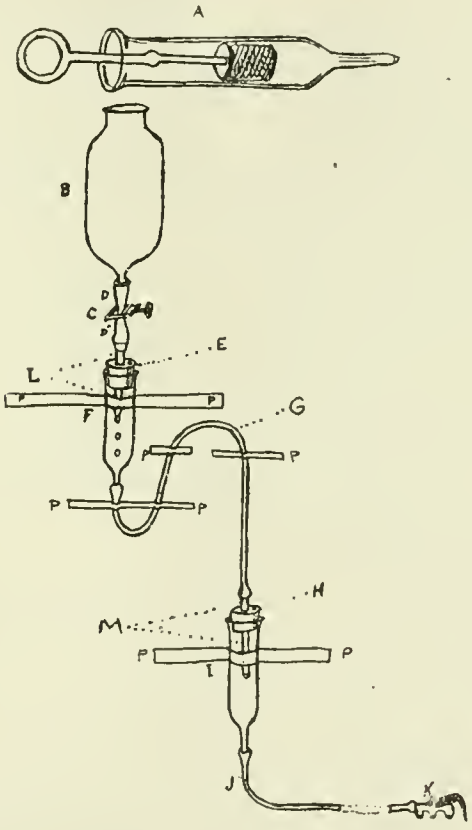
It occurred to the writer that much responsibility might be taken from the nurse if a simple and inexpensive method could be devised which would automatically flush the wound at desired intervals with a uniform and easily determined quantity of solution. Accordingly, after some experimentation, the apparatus indicated in the accompanying diagrammatic drawing was perfected. In practice the little device has given great satisfaction.

A represents a one-ounce (more or less) glass syringe which can be purchased for a few cents. There should be two of these and they are used without the pistons. *B* is the irrigator which forms the reservoir for the Dakin's solution. *DD* is a red rubber tube attached to the outlet of *B* and passing through the screw clamp *C*, as shown in the picture. At the lower end of *D* there is a medicine dropper *L*, the lower end of which should be large enough to cause the formation of a large drop of solution when the clamp *C* is properly set. This medicine dropper passes through a cork, which, in addition to the central orifice, to permit the passage of the medicine dropper, has a small airhole perforation. *F* represents one of the syringes. *G* is a red rubber tube about the size of a 15 French catheter, but the exact size is not important. It is formed into a syphon and at the termination of its long arm there is a glass tube *M* of uniform caliber, not pointed at the end. This glass tube passes through a perforation in a cork and in this cork there is also another small perforation as an air vent. The cork is fitted into a second glass syringe *I*, and to the nozzle of this second syringe the red rubber Carrel tube of proper caliber is fitted. This red rubber tube passes to the wound where the Carrel glass terminal *K* is fitted into it and from *K* the tubes pass in the well-known manner to the infected surfaces which are to be treated. The bottle *B* is on a stand beside the patient's bed. The remainder of the apparatus, down to the syringe *I*, is fixed to a board, either with wire, cord or even adhesive plaster.

[1] This apparatus, made specially with a glass syphon instead of the rubber tubing, was demonstrated before the New York Surgical Society at its regular meeting on December 12, 1917. The use of the syphon in apparatus for emptying hollow viscera is not new. Indeed, Capt. A. J. Bendick, M. R. C., applied this principle some years ago in a device for keeping the bladder empty after suprapubic cystotomy.

The latter, indeed, is the simplest thing to use. It is shown in the diagram by *P*, *P*.

Operation.—The highest point of the syphon *G* will determine the amount of liquid which will be emitted at each flushing. The higher the curve of the syphon the greater will be the quantity of fluid at each emptying. The clamp *C* is screwed down just tight enough to permit a drop to fall from the point of the medicine dropper *L* every fifty or sixty seconds. One drop a minute means 120 drops in two hours. The syringe *F* gradually fills until the highest level of *G* is reached, after which the next drop or two will cause an immediate emptying of *F* by syphoning into *I*, from which it quickly drains off to the wound. The syringe *I* is necessary because, were the tube *G* to be continued down to the wound, the apparatus would become air bound and would work irregularly. The entire apparatus is easily sterilizable and, when once set, is sufficiently accurate for all practical purposes.



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THE
MILITARY SURGEON

VOL. XLII MARCH, 1918 NUMBER 3

ORIGINAL ARTICLES

Authors alone are responsible for the opinions expressed in their contributions

MALINGERING IN U. S. TROOPS, HOME FORCES, 1917[1]

THE OFFICE OF THE SURGEON GENERAL, U. S. ARMY

THOSE who allege, counterfeit, exaggerate, create or conceal disease in a military environment can be divided roughly into two groups: One containing those who do so with full knowledge, intent and responsibility; and a second group of which the members are hypochondriacs or constitutionally inferior individuals who, throughout their lives, have never been able to meet disagreeable situations without complaint and ruse, deceit and evasion. The first group, in the present mobilization at least, is small. Few cases have been brought to court-martial, and the consensus of opinion has been that most of the malingerers had something the matter with them. For example, the medical service at Camp Hancock reports that "viewed from all angles no patients could be accused of a deliberate attempt to deceive."

The second group contains the large numbers. One surgeon expresses himself as convinced "that in almost all of the cases in which defects were simulated or exaggerated, the patients were actually defective either in a lesser degree or in a different affection or in both. Whether the malingering took the form of mental or nervous or physical defects it was based, in almost every instance, on an actual unstable or defective mental state."

The progress of medicine has altered the military aspect of malingering. It has rendered the act itself much more difficult of accomplishment and in this way has decreased the numbers in group one. Group two, on the other hand, has been enlarged, as the increase in number and accuracy of diagnostic methods, and the clinical recognition of glandular disorders, bone diseases, psychopathic states, etc., formerly unrecognized, has resulted in soldiers now being sent to the hospital who twenty-five years ago would have been sent to the guard house.

[1] Bulletin compiled from the reports of medical officers, by Maj. Pearce Bailey, M.R.C., U. S. Army.

To-day the medical officer's chief duty in reference to malingering is to determine the degree of inferiority which underlies it, and to frame recommendations so as to ascertain whether the malingerer, with his particular defects, is of the stuff of which a soldier can be made. Whenever the question is doubtful, he should hesitate in recommending discharge, because the administrative management of malingering, as will be made apparent in succeeding paragraphs, requires that as few discharges as possible be granted.

Frequency.—The diagnosis of malingering, in general, remains a matter of medical opinion. It is unusual for it to be entered on records as attempted fraud. Considered as an offense for which conviction could be obtained at court-martial, it has always been exceedingly rare. It is not mentioned by name in the Articles of War, Army Regulations, or Manual of Court-martial. In the German Army, for the period of 1894–1908, there were 43 cases. In the French Army, during a period of 37 years, there were 308 cases. The records of the present inquiry show only one case in which a verdict of guilty was found at court-martial. Malingering in general has also been reported as infrequent. The surgeons of several National Army divisions have reported it as not troublesome, and surgeons of several National Guard divisions have reported no cases at all. It is naturally most frequent at the National Army camps, but even here it probably has never reached a figure in excess of 1 per cent of the whole command, a few hundred cases of all kinds. This percentage and these numbers may have to be increased when the men of the first draft are reexamined, as it seems probable that some did feign disease successfully at the draft boards.

In the camps, the diagnosis of some simple malady is usually entered on the records and the man returned to duty. In most cases there is doubt enough as to absolute fraudulent intent to make this unavoidable. Sickness is more popular in the army than elsewhere, if only for the reason that it means stopping work and costs nothing. One surgeon makes the following remarks in this regard: "Of those coming to sick call and dispensary, 10 per cent are pure malingering, 40 per cent exaggerate symptoms, which would not be sufficient to cause a cessation of work in civil life, 40 per cent somewhat sick and would stop work in civil life, but would not send for a doctor, 10 per cent quite in need of attention and in civil life would stop work and procure medical attendance."

General Causes.—The more clearly the examiner has in mind the personality traits and the actual causes and conditions underlying the pretensions of the more or less defective persons who feign or exaggerate symptoms in order to evade their duties to their country as soldiers, the

more easily will he be able to establish the presumption that a self-alleged sick man is playing a part.

The present mobilization has shown that the foreign born resort to this form of deception more than the native American, and those from the central and eastern portions of Europe more than those from the western section. The reason of this is that many of them are Jews, a race that has always been averse to belligerency. As estimated ratio of malingerers among our troops has been given as:

Jews, foreign	5
Jews, native	3
Other foreigners (notably Italians)	2
Americans	1

Little malingering to escape *service* is reported among the northern negroes; what there is among negroes from the south is said to disappear as soon as they are given their uniforms. After that they malinger to evade *duty*.

Generally speaking, there are two main types of malingerers: country and city. Those of the country type are foolish and clumsy in their attempts, often grotesque, come to camp provided with recently purchased apparatus such as green spectacles, trusses, or with allegations that varicoceles, hydroceles and the like are ruptures, complain of pains in the back, kidney disease and similar ailments in a foolish, unconvincing way.

City malingerers are much more astute. They are generally familiar with the jargon of the metropolitan clinics and are apt to make their complaints less specific.

Of the underlying causes, fear and timidity are unquestionably the most frequent and conspicuous and probably underlie all the others. But fear and timidity may exist as constitutional qualities and may have determined the mental attitude or choice of career in persons who are not cowards superficially, or who even may be capable of acts of physical courage. They may have become established traits of character, inconspicuous or even reputable in peace, though springing from fear; and would not have involved imputations of cowardice against those who possessed them except for the exactions of war. Chief among the representatives of this class are the conscientious objectors (who cannot be regarded as malingerers) who, years ago, individually or as members of religious sects, interpreted the Scriptures as making no distinction between warfare and murder, and who made up their minds to take no part in either.

Motives of personal advantage, especially mercenary, can often be

established as the basis of unwillingness to serve. A number of malingerers who had claims pending for injuries received in civil life are reported. Men hate to give up good jobs or to lose chances to make money. Then many are really interested and contented with what they are doing and are resentful at suddenly being called upon to throw it all over for something in which they discern no personal advantage. Farmers are frequently quoted as saying that this is not their war, that Germany is a long way off, and that they could be of more use to the country, anyhow, if permitted to go on with production in their own peaceful way. In Quebec, love of farming outweighed patriotism among the French. It appears from the Provost Marshal General's report on the operation of the selective service draft law that twelve in every hundred drafted agricultural registrants filed claims, while but two in every hundred drafted non-agricultural registrants filed claims.

The lack of national feeling makes it easier for such motives as personal comfort, family reasons and laziness to prompt men to malingering to avoid what they feel to be of no personal interest. Given lack of patriotism, it would be easy to construct a satisfactory moral defense for almost any deceit in evading military service.

One surgeon reports:

There were many instances where men asserted that exemption was necessary in order to render financial support to their families, although the present rate of Army pay was equal to and sometimes exceeded their financial income in civil life. When the discrepancy was called to their attention, there would be substituted some existing physical impairement, or history of injury or illness in earlier years which would be given as an excuse for inability to drill or perform other military duties.

Draft men on occasions would report on sick call or approach the surgeon at odd times in the organization area, requesting consideration for exemption on account of alleged physical impairment of some member of his family. In several instances, questioning failed to substantiate the reasons given, which resulted in the man resuming duty and satisfactorily discharging the routine thereof.

Men who try to evade military service for family reasons of this kind usually approach the matter of disqualification more frankly and intelligently than the ordinary slothful malingerer, seeking release through the legitimate procedures prescribed by the Federal Government.

Gross ignorance is responsible for much malingering. This ignorance proceeds, not from illiteracy, but from an almost unbelievable lack of information concerning the simplest conditions of life. Many of the miners, mountaineers and farmers of the southwestern and southern states are reported as not knowing why or whom we are fighting, not

even knowing that a war is going on. Under such circumstances, they easily get the idea that the Army is some kind of a punitive institution and naturally enough try such simple measures as their primitive minds are able to compass, to get out of it.

It is probable that there would be even less of malingering in our troops did not service imply fighting outside the confines of the United States. A considerable proportion of drafted men are of German or Austrian birth and ancestry. Some of them state that they have relatives in the armies of the Central Powers and that, while they are willing to fight in case of invasion, they are not willing to fight abroad.

But the largest numbers of malingerers are found among those who take the same attitude toward military service which they have always taken toward everything in life requiring orderliness, obedience, industry, and unselfishness. Their essential timidity has shown itself in evasion, which has become a habit with them, and they have indulged in it in the past by truancy, by running away from home, or later by throwing up jobs, when conditions became disagreeable, by vagrancy, by illness as an ever-ready excuse for not doing their duty in the world. Military service brings them to light, but the Draft Law has made no fundamental change in their characters or in their behavior.

An idea of the general causes, as observed in a group, is given by the following classification of 126 malingerers observed at Camp Hancock. With the exception of twenty-one of them, they seem of obviously questionable mentality.

Those who feign or exaggerate sickness to get out of work	25
Professional shirkers	15
Those slow to comprehend	9
Those to whom all duties seem hard and have an idea they are imposed on and are never satisfied	14
Neurasthenics	16
Continual offenders	9
Lack of adaptibility to soldier life	10
Religious fanatics	5
Those who are unable to keep clean	10
Those who are always complaining of an old injury to avoid work and which upon examination shows no evidence to corroborate the complaint	6
Those who try to have assignments changed claiming present assignment is too difficult	10

Motives.—The following motives, in relation to the military situation, are demonstrable:

1. *To Evade Service.*—This is by far the most common purpose behind all malingering in our troops and is most frequently encountered among

drafted men. In all other branches of the service, to malinger necessitates the reversal of a choice already made and is consequently much less frequent than in drafted men, who have had no choice in the matter. Large numbers of them, on their first arrival at camp, are reported as discontented and dissatisfied. Under the benefits of camp life, which result, even in the first few weeks, in improved health, as shown by rapid gain in weight, the vast majority settle down and adapt themselves contentedly, generally enthusiastically, to a life better calculated to insure peace of mind than any they had previously known. For this reason, during the first few weeks after arrival at camp, rejections of drafted men should be made only for unquestionable defects and no estimate of the frequency of malingering should be attempted at this time. It is also evident that a reasonably long probationary period prior to mustering in is essential to the eradication of malingering. In contrast with those of the National Army, malingering to evade service in the National Guard cantonments has been practically absent. From only one of these cantonments come reports of self-inflicted wounds in men off duty. The difference in malingering between these two classes of soldiers has been conspicuous in those cantonments of the National Guard to which drafted men have been sent to complete unfilled regiments. More malingering for the purpose of evading service has been observed in these transferred quotas of drafted men than had been previously observed in the whole National Guard division. The factor of voluntary choice has, of course, most to do with the conspicuous infrequency of malingering in the National Guard, but it should also be remembered that most of the enlisted men of this branch of the service had already served during the mobilization on the Mexican border in 1916, so that probably most of the malingerers had already been cleared from the ranks.

The same infrequency of malingering is noted in the volunteer army as in the National Guard, and this in spite of the fact that voluntary enlistments were so greatly stimulated upon the inauguration of the draft. The surgeon of the Columbus Barracks Recruit Depot post writes as follows:

> Considering the large number of recruits examined, there has been little malingering (with the object of avoiding service) at this post. The reason for this is the fact that the recruits have volunteered during the war and the natural presumption is that, with very few exceptions, they have desired to enter the service and fight. This was especially so during the months following declaration of war. Besides, volunteer applicants reporting here have been selected from many applying at recruiting stations in Ohio and the surrounding states, and most of the potential malingerers have been weeded out. By far the largest number of malingerers here have acted with a worthy and not an unworthy

motive, *i. e.*, they have endeavored to conceal a disqualification. Those who have malingered to avoid service can be broadly divided into two classes: (*a*) those applying honestly primarily, but subsequently changing their minds, either as a result of homesickness, or a belief that service might present hardships that they did not think of when first applying for enlistment; (*b*) those applying with the deliberate purpose of being physically rejected. Class (*a*), with no preliminary or definite idea of how they will malinger, are usually very crude and easily detected. Class (*b*) have worked out various methods of attack and require more time to detect. Very few of them, however, show any great skill. The reason that this class tries to avoid service is to escape subsequent draft by showing a rejection for physical disability, or to pose as decent men when they are slackers. The majority of them are actuated by selfishness, the minority by lack of ordinary physical courage.

2. *To Avoid Duty.*—It is obviously impossible for a medical officer always to be sure of the exact motive which lies behind an attempt at malingering. Probably a majority of those who are reported as malingering for the purpose of avoiding duty would accept discharge if they had the chance at the time. They might apply again for enlistment, but would nevertheless leave the army at the moment of their fancied grievance. It is probable that many of the frequent cases of paralysis of one limb, in all of which there is a strong hysterical element, are associated with wishes, momentary though they may be, to be quit of service. These only half-conscious pretenders lack the persistence to carry it through, and the quality of the motive ascribed to them should really be referred to in terms of their own childishness. Such a case is reported from Camp Logan:

> Enlisted man gave history of being kicked by a mule, at the junction of the sternum and clavicle, on the right side. Absolutely no external signs of an injury at any time. Patient complained of a complete paralysis in the entire right arm. Claimed to have absolutely no control in the arm, and insensible to pain. After a very close examination of this man, and being of the opinion that he was a malingerer, we threatened to send him to base hospital and, under an anesthetic, give him certain tests that he would not be able to fake on. He, being of the opinion that he would be caught up, had a very remarkable cure over night, felt a jolt in his shoulder and gained complete control of his arm.

But while it is difficult or impossible to be sure of the motive in individual cases, the general consensus of opinion that men making these minor complaints do go back to duty and make good soldiers, leaves little reason to doubt that the troops of the present mobilization, after they have become accustomed to army life, are not possessed with desires to leave the service strong enough to cause them to feign disease persistently.

"Sodgering" is as old as armies. It is resorted to by men who do not necessarily want to get out of the army, but who are chronically interested in getting out of all the unpleasant and fatiguing duties they can. To this end, they exaggerate every minor ailment that they can, complain of pains, headache, lame backs, sore feet, and in fact of all the complaints common to any free dispensary. They may be average good soldiers, but lack pride and a sense of responsibility. They may not shun ordinary duties, only the disagreeable ones such as guard duty and hikes; for example, men complaining of flat feet try to get out of the marches only. They are familiar to all regimental surgeons who hold sick call, and only a few of them ever get sufficient encouragement to reach the base hospital. The motive behind malingerings of this kind is plain from the fact that they become much less frequent on Sundays and half-holidays. To counteract this tendency, it was required at one camp that unless men marked "quarters" report at next sick call they would be put back on duty. In another, where an evening sick call was established, complaints of this character were much less frequent at the sick call which ended the day than at the one which began it. The following is an example of a case in which symptoms are resorted to to effect a change of duty.

Recruit, aged 22. In service about six weeks. Reported at sick call complaining that he had almost lost the use of his hands. He was given some simple directions, but appeared daily at sick call for three days, each time complaining that he was losing the use of his hands. He was then admitted to the hospital for observation. A careful examination resulted in negative findings. By that time he was scarcely able to dress himself. He was put on liquid diet and, after four meals of this kind, complained of being hungry. Just prior to the next meal he was told that he could go to the mess hall for that meal if he could dress himself before going. He promptly dressed himself without difficulty and it was observed that he had no trouble in handling his knife and fork during the meal. On returning to the ward after the meal, he again found that he could use his hands only with great difficulty. He was at once interviewed by a medical officer and, after a short talk, found that the trouble with his hands had entirely disappeared and he was ready to return to duty. On investigation, it was found that, a few days prior to the appearance of his illness, he had been given work with the kitchen police and was much dissatisfied with this work. He acknowledged that he thought if he persisted in his complaints of inability to use his hands he would be given work which suited him better. It seems that he had once known a patient who had paralysis involving the hands and forearms. A warning as to the serious consequences which might follow malingering was sufficient to make his cure permanent.

There are men who for various reasons get angry with the officers, especially noncommissioned officers, and, for spite, evade all duties

possible. As this can only be done by fooling the medical officers, they come to him complaining of various and indefinite pains. The malingering, as a rule, lasts no longer than the cause of it and the man returns to duty a good soldier.

3. *To Obtain Service.*—The most frequent form of falsification for the purpose of obtaining service is the concealment of immaturity, boys of fifteen, sixteen and seventeen passing themselves off as eighteen and over.

This form of malingering is mostly limited to volunteers, although occasionally drafted men conceal disabilities for the purpose of being accepted or of remaining in the service. One such, stone deaf, a skillful lip-reader, passed the exemption board and the preliminary examination at the camp, his disability being finally discovered because he was unable to execute commands.

At recruit depot posts, chronic alcoholics endeavor to conceal their disability for the purpose of obtaining service. Next to them in number are epileptics who conceal their histories. It is stated that the former want to enter the service in order to gain the livelihood they cannot earn outside, while epileptics appear nearly always to be actuated by an honest desire to serve their country. Many of them make every attempt to remain in the Army. In one case at Camp Upton, a man who had been twice discharged from the Army under previous enlistments concealed the fact of his previous discharges and the disease, in order to be accepted under the draft. When, after having convulsions, he was about to be rejected, he announced his determination to join the Canadian or English forces. Drug addicts occasionally try to conceal their habits and are apt to choose for service the Medical Department, perhaps by reason of former associations or because they think they will there have better opportunities of obtaining the drug.

4. *To Obtain Exemption from Punishment.*—A soldier was to be tried by a general court-martial. A few days before the trial he requested an examination by a mental specialist. He claimed mental aberration due to a blow on the head, which the psychiatrist who examined him considered wholly feigned.

Soldiers in confinement are always prone to exaggerate and magnify their complaints, and the sick call for prisoners is always large. It was regarded as a praiseworthy evidence of patriotism in Germany, at the outbreak of war, that the complaints of prisoners diminished by half.

5. *To Obtain Transfers.*—This does not appear to be an important motive for malingering in our troops. A few men have made complaints of pains in the feet with the idea of being transferred to the Quartermaster's Corps, and timid men have sought transfer to the

Medical Corps, either on their own initiative or that of their company commander, on the understanding that the work was easier and less perilous. One conscientious objector applied for transfer to this corps and was told that he would be stretcher-bearer in No Man's Land. He conquered his scruples and stayed where he was.

Suggestion.—The factor of suggestion through a cause is so important that it requires separate mention. As it concerns the recruits of the present mobilization, it must be considered from two angles, viz.: the suggestions which arise from the immediate surroundings, and the effects of those suggestive influences which the recruit had gone through in the past and which he brings to camp with him as part of his equipment.

As far as the first are concerned, waves of nervous symptoms have always had a tendency to sweep over and more or less disorganize large bodies of men. They become less and less noticeable as discipline is perfected, but at the beginning they are readily communicable. For example, among the present recruits, men coming from the same communities show a similarity or identity of their symptom. In certain organizations there was such an agreement as to suffering that the same nervous complaint would be made simultaneously by large numbers. Complaints of flat feet run in companies, and various outside influences would have the effect of calling forth, all at once, a large crop of related ailments. Lectures would create apparitions of the diseases lectured upon. One admission for a given disorder, to a base hospital, when it was the only building provided with stoves, would be rapidly followed by many other disorders of the same kind. At Camp McClellan, in October, a bed wetter was admitted one night, three bed wetters the next night, and, on the third night, there were no fewer than sixteen bed wetters in the hospital. The visits of special boards are apt to be followed by an increase in complaints of the special diseases the boards were sent to eradicate, *e. g.*, complaints of hemoptosis following the tuberculosis board, of pain over the precordium after the cardio-vascular board, tremors and flat feet after the boards of neuro-psychiatry and orthopedics. Complaints are regularly volunteered for any disability for which S.C.D. is given. It is probable that many such cases owe their origin to the examiner's habit of talking conditions over before the men and of asking leading questions. One division surgeon noted a great improvement when he had admonished examiners in these matters. Such symptoms are usually created before the patients reach the base hospitals. But there the symptoms run the risk of becoming fixed, and new ones are created by imitation. Tremors, fits, paralysis, etc., can often be traced as to origin, as being suggestively transferred from one patient to another.

But in contrast to this immediate or contemporary suggestion, so common to crowds and so readily recognizable, is another variety which has warped the lad's courage and independence in the past. This has come to him through "old wives' tales" of all kinds, from his visits to anatomical museums, from quack advertisements, from over-solicitude for his health on the part of his parents, from the statement of ignorant or unscrupulous physicians who have treated him for years for "stomach trouble," who have told him that he had a weak back, that his kidneys were not strong or that he would develop hernia or break down under the strain of army life. By these means his mind has become weakened in its powers of discrimination, and under the excitement and homesickness and fear of the first few weeks of separation from what he had always been accustomed to, when he feels the fatigue or pain of the unaccustomed exercise, he comes to believe that what he has been warned of in relation to his health has arrived. Others have always been coddled at home and led to believe that they were delicate, unable to stand hard work, and never risked trying it. A number of letters have come to the Surgeon General's office from parents requesting the discharge of their sons mustered into the service, urging discharge on the ground of delicacy. Inquiries concerning these sons have brought out the information that they were at last in perfect health and personally had no wish to be out of the service. The attitude of some parents in such matters is typified by the remark of one father who, on being told that his son was not paralyzed, but had a functional disability which would quickly recover and which was not a cause for discharge, exclaimed "I am awfully sorry to hear it."

The effects of suggestions of this kind, while responsible for many of the cases of fancied illness called malingering, are not always immediately recognizable as such. To get at their true nature implies that the examiner must establish between himself and the recruit some relation during which the whole story comes out. The reports of the present inquiry abound in instances of recruits who went back to their duties cheerfully after the medical officer had confidentially assured them that there was really little or nothing the matter with them.

Detection and Management.—The present method of inquiry was chosen for the reason that few of the books on malingering give a representative idea of the condition, as it is being observed in the U. S. troops today, nor of the best way of treating it. Our records show that the malingering recruit of the Army is rarely the resourceful juggler of the books, who is only to be caught in the same traps that are his own stock in trade. There are still some of these, but too few to constitute a real problem. There are still to be found malingerers of the

criminal type, who have aptly learned their lessons in reformatories and similar institutions, drug addicts and gangsters, recent products of the cities, who are inventive and resourceful in all forms of deception. The acrobats and contortionists still dislocate their joints or cause contracture of certain muscles at will (the latissimus dorsi in one case), and the low comedians continue in the Army the same methods of deceiving their audiences as had previously brought them a livelihood. But these are the exceptions, and when they succeed they do so, not because they mimic disease well, but because the examiner is professionally unskillful and personally less watchful and adroit than those it is his duty to detect. The great bulk of malingerers who constitute problems for medical officers are simple, credulous, impressionable boys, who exaggerate and invent without skill, or with no definitely conceived plan. To detect them—to understand them is a better expression—requires accuracy in diagnosis, knowledge of human nature, and especially knowledge of the types of persons who chafe under military service and why they do so. One prevalent idea seems to be that the malingerer is to be "unmasked" by specially devised tests. The fact is that, with the exception of cases in which deafness or blindness of one side is claimed, the only tests or instruments required are those regularly employed in medical diagnosis. The final method, and one which is now generally practicable in the Army, consists in a stay in hospital wards under the observation, when necessary, of specialists.

As a practical issue, the detection of malingering has been narrowed down to the recognition of self-induced, factitious conditions, and to the estimation of the degree of exaggeration in complaints of actual or preëxisting diseases, conditions or injuries. With the exception of self-mutilation, such as the cutting off or shooting off of fingers or toes, a brief hospital sojourn is usually sufficient to show up the fraud underlying self-induced symptoms and inflammations.

As concerns the exaggeration of existing defects, the medical officer has two practical questions to decide: One is, do the complaints concerning present discomfort and suffering, as compared with the actual conditions found, transcend common sense and medical experience? The other concerns the determination of the motives which led to the exaggeration. The first is a purely medical question, and can never be answered with assurance unless the physical examination has been painstaking and thorough. In this connection, it should be remembered that examination which show the absence of disease confirms a general appearance of robust health. It may also disclose evidences, such as local callosities on hands alleged to be useless, or on feet which the recruit says have been paralyzed for months, which absolutely contradict all

complaints as to disability. When the examination has fulfilled these conditions and the complaints contradict the actual findings, an investigation of the motives should be made for the purpose of substantiating the suspicion of malingering.

The real motives can only be appreciated if the type of personality is brought up to the surface, and this can be best done if the man under investigation be allowed or induced to tell his own story. This is easiest with persons of some intelligence and education, for such, in contrast with dull, untutored persons, lay themselves open to suspicion when too reticent. Those who talk freely can be counted on, with almost absolute certainty, to say things quite at variance with the possibility of the disease existing of which they complain. The questions are better put as a rule, and the answers more readily comprehended, when the examiner is from the same part of the country as the recruit and familiar with the social conditions of the particular community. The motives for deception will be found inextricably bound up with the man's life history, but the questions put to elicit them should appear as part of the regular medical examination. Even if the examiner's suspicions are aroused at the start, his attitude at first should be that of the inquiring, impartial physician, not that of a court officer.

He should get all his facts before letting the recruit see that he is under suspicion. The questions should result in information about the recruit's family relationships, his progress at school, his industrial career. Was he happy at home? Did he ever run away from it? How far did he get in his schooling? Was he a truant? What led him to choose the the career or careers he had followed before entering the army, and did he change them frequently? How much did he earn and what did he do with his money? What have been his relations with women and children, and had he ever deserted women who were dependent upon him? The answers to such questions will often flatly contradict the possibility that his present claims are genuine. It is highly important to discover the man's mental attitudes and the character of his general ideas. What has been his adjustment to general social conditions? Has he been a "good mixer," or solitary, secretive and morose? Does he bear grudges against a good many people with the idea that they are trying to get the best of him? What have people thought and said of him anyway? Does he think the world a good place to live in and enjoy? If not, why not? What are his views as to war and the rights of the individual? The various causes and motives of malingering mentioned in the preceding paragraph should be borne in mind during this inquiry.

It is especially important to direct questions toward the suggestions the recruit may have received in regard to his health, for many healthy

recruits are themselves convinced of their own weakness and frailty, and when assured to the contrary they go back to duty with the air of having a great load taken off their minds. Here explanation and persuasion may be turned into an effective means for detection and cure. In the same way, appeals to manliness, references to fraudulent enlistment, threats of court-martial, or of disagreeable duty, statements that the complaint alleged is not a disqualification, identify or remedy malingering. One officer finds it important to use a tone of voice suitable for each class: For the talkative malingerer, a conversational tone; for the "sigh and sob" malingerer, a sympathetic tone; for the stubborn malingerer, a quick, sharp tone.

Patients sent to base hospitals are apt to become careless and be off their guard, to be seen to move limbs supposed to be paralyzed, or in other ways to give positive proof that their claims have little foundation in fact. Light diet, disagreeable medications, etc., cause many pretenders to give in, and the special diagnostic equipment of base hospitals sets the malingerers an almost unsurmountable task.

Anesthetics for diagnostic purposes are frequently given, as, during semi-consciousness, the patient often says things which contradict previous statements. During anesthesia, also joints held immovable for a long time are shown to be freely capable of full movement, although the absence of organic disease, proved in this way, does not exclude functional nervous disease of extremely persistent character.

Distraction of the attention is an important aid in the detection of malingerers—the patient should be examined for one set of symptoms, while he believes himself under examination for something else. By these means he is taken off his guard, and is discovered by the factor of surprise.

The general management of malingering in a military organization consists in efforts to suppress as far as possible all the influences which have been shown to be causes, and the issuance of such orders as will tend to make malingering difficult and disagreeable. Examinations should be conducted, as far as possible, without the recruits knowing the details of them and without their hearing discussions of the cases. As many cases as possible should be disposed of without being sent to the hospital at all, and those sent should not be told why they were sent. The inference of actual illness should always be kept in the background. Visits of friends and relatives should be discouraged, especially in the early days of mobilization. Firmness and avoidance of sympathy are essential. Various orders have been reported as diminishing malingering, such as penalizing the soldier his weekly holidays, if on company sick book and marked "duty" by the surgeon; treatment of complaining by

confinement to quarters, when not on duty, for the week, and forbidding visits to any places outside of camp, etc. It has been said that the "war neuroses" have been kept in check in the French Army because the soldiers generally understand that these neuroses would not constitute a cause of discharge.

When it has been satisfactorily proved that there is no basis in fact for the disability claimed, sufficient to warrant exemption from service or duty, there still remains the question, what to do with the soldier who adapts himself to military life in this unsatisfactory way. Court-martials do not seem particularly adapted to meet this situation, and, as a matter of fact, most of these offenders are returned to duty unpunished. In the cases of the individuals in whom the attempts at deception can only be considered as symptoms of a long-standing neurosis it is necessary to decide whether they can be turned into useful soldiers under any conditions. Many of them cannot, and such must be promptly discharged. It is, however, believed that some of this class who are at present discharged could, after the exact type of their neurosis had been determined, be made militarily efficient under drill, strict discipline and duties, selected during the period of their reconstruction. The following expression of opinion from a medical officer merits careful attention:

> I believe that fully two-thirds of the cases I have seen would make good, useful soldiers if they could be properly apprehended and handled. There are so many borderline cases in which it is so difficult to determine how much real disability exists, and how much is simulated, that it has occurred to me that, in a place of this size, it might be profitable to have all wards send their doubtful cases to one ward, and place them under the care of one man, who could devote his attention to this class of cases.

(*To be continued*)

SOME OBSERVATIONS ON INJURIES OF THE HEAD

By Major HOMER GAGE

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ALTHOUGH injuries of the head demanding surgical interference must of necessity be rarely met with in a cantonment Base Hospital they are of frequent occurrence in the zone of action and of the greatest importance—varying in severity from the slight scalp wound to the comminuted depressed fracture of the skull complicated by the presence of one or more foreign bodies in the brain.

There is no class of injuries which calls for the exercise of greater judgment in determining when and how much operative interference is indicated, or which demands a higher degree of technical skill in operating in order to minimize the chance of increasing an already serious hazard. It is therefore essential that anyone who contemplates surgical work at the front should, so far as possible, familiarize himself with a general knowledge of the emergencies which constantly attend its practice.

I am quite conscious of my own inability to give you anything that is novel about the subject, but in response to request I will try to state briefly the important points in the treatment of head injuries as they have been impressed upon me by the experience of an active surgical service in a municipal hospital, and will supplement that by some references to the experiences of the European surgeons as reflected in the current war literature.

In the first place one fundamentally important thing for us to remember in considering head injuries, by which term for the purposes of this discussion I mean only injuries involving the cranium and the brain, is that injuries to the bones of the cranium are of importance only as they expose or injure the brain and its membranes. If it were not for this the bone injury would require little, if any, interference. It would certainly present no difficulties.

In the second place, remember that anatomically the cranium is a hollow shell with sufficient elasticity to bend and to rebound, thus changing its diameter under the impulse of a blow and making an important difference in the mechanism by which its injuries are transmitted. For example, the injury may result in a local bending with the lesion at or under the point of contact; or it may result in a bursting of the wall opposite the point of contact with a consequent distant lesion, the most common illustration of which would be a blow upon the vault causing a cracking of the bones of the base; or lastly, the injury

may result from the expansive force of a missile passing through the skull at high velocity—an explosive injury.

These are all helpful points in diagnosing the nature of the lesion in a given case and emphasize the importance of getting at the exact nature and direction of the forces applied. The smaller the point of contact between the force and the bone the more likely is the lesion to be the result of bending of the skull and to be localized at the seat of injury, as in a blow from a hammer; *e. g.*, while the broader the point of contact, as in case of a large blunt instrument or a fall on to the vortex of skull, the more likely is the injury to be a bursting one on the opposite pole of the hollow skull.

Bearing in mind these underlying principles, let us look for a moment at the picture of head injuries as we ordinarily see them in the accidents of civil life.

In the milder cases we see a partial unconsciousness from which it is possible to rouse the patient by voice or touch, or a condition not unlike that of a drunken stupor, followed by headache, dizziness, nausea, vomiting, etc.; and if the recovery is steadily progressive, even though slow, we call it concussion.

If the stupor persists and deepens and evidences of compression supervene with delirium, restlessness, slow pulse, choked disc, etc., we call it contusion, and say it has resulted in hemorrhage. As a matter of fact I think that Kocher's view that both conditions are due to hemorrhage is most reasonable; in the milder cases the hemorrhages are microscopic and widely scattered, in the severe ones larger and more localized. In other words, in all cases where definite symptoms of cerebral disturbance supervene I believe the pathology to be one of hemorrhage and brain laceration, minute and microscopic, if you please, in the milder cases, but always laceration.

This was illustrated in a recent case of a young girl struck by a trolley car in a collision—"no sign of external injury, unconscious but would respond to stimuli, appeares to be a simple concussion." As she did not recover consciousness and was increasingly restless the diagnosis was changed to severe contusion, and as she grew steadily worse it was changed again to probable fracture of the base. Autopsy revealed no fracture, but numerous punctate hemorrhages scattered through the brain, the largest in the corpus callosum as large as a pea with a surrounding area of softening.

I think this is a fair illustration of how the terms concussion and contusion are really misleading if used to describe essentially different conditions, but are correctly used only to express a mild or a severe

type of cerebral injury with the same pathology, viz., hemorrhage of greater or less severity.

An important variety of the severer type is that which presents an interval of from a few minutes to a few hours of complete consciousness followed by a steadily deepening coma with slow pulse and progressive unilateral paralysis; this represents the typical picture of middle meningeal hemorrhage which often exists without fracture and without any injury to brain substance.

Unless quickly relieved, death follows usually within twenty-four or forty-eight hours from increased intracranial pressure; localization is easy from the presence of a limited one-sided paralysis, and the operation constitutes one of the most striking and satisfactory surgical procedures that I know of.

The effect of the injury may not be limited to a simple concussion or even contusion; it may be the result of a violence greater than this, and sufficient to break the skull in which the brain is contained. This leads us to the consideration of fractures of the skull; just as in the case of the long bones, these fractures may be simple or compound, according as the scalp is or is not intact, and both simple and compound fractures of the skull may or may not be comminuted.

Into the natural history of the compound fractures enters, as it does in all fractures of all bones, the element of possible infection; aside from this possible complication it makes little difference whether the fracture is simple or compound or even if it is comminuted or not. The important factor is the effect of the fracture on the brain and its membranes: the vital question to be asked is: Has the brain and its membranes been injured, and, if so, can we do anything by way of repairing the damage?

In either form of fracture we may have intracranial hemorrhage and the hemorrhage may be accessible or inaccessible—we can often do but little to control it or to prevent the softening which often accompanies it—in either form we may have the edges of a fracture or the pieces of a comminuted fracture driven into the brain, and then we call it a depressed fracture, and the important thing about it is the depression. Because, as we said at the outset, we are concerned not about the fracture—that will take care of itself—but about the effect of that fracture on the underlying brain, that is the one thing that must never be lost sight of.

In considering perforating wounds remember that they are really depressed fractures, and that the bones of the skull have an inner and an outer table; the effect of a perforating wound is therefore often to splinter the inner table more than the outer, leaving small fragments

penetrating the brain. These, if overlooked, are apt to have an important influence on the future health of the individual.

Besides knowing something about the kind of fracture it is important to consider its location. For this purpose we may conveniently divide them into fractures of the vault and fractures of the base, always bearing in mind that in the bursting fracture the fissures may pass from one area to the other, *i. e.*, a crack in the temporal or parietal region may pass down through the base. All depressed fractures are of course included in the injuries to the vault and in certain areas, particularly the frontal region, these may be very severe, accompanied by extensive laceration of the brain even with considerable loss of brain tissue, and yet have few symptoms of brain injury. Over the motor areas, on the other hand, lesions of much less apparent severity may result in most serious impairment of function.

The fractures of the base are always fissured fractures, which usually pass through the anterior or middle fossa, and are really compound, because they communicate with the nose and its accessory sinuses or with the mouth or ears. The danger of infection is always a serious one and every effort must be made to keep the communication clean, *e. g.*, in fractures through the petrous portion of the temporal bone with bleeding from the ear, be sure to wash out the external auditory canal with a mild antiseptic like boric solution and keep it closed with aseptic absorbent cotton.

I have always observed that those fractures of the base that bled freely externally were the most favorable. But one is often surprised by the steady improvement that takes place in these most serious injuries and can only conclude that, if the danger of septic infection is safely passed, death results only when there is extensive intracranial hemorrhage complicating, but not the result of, the fracture.

Operating for the relief of the severe cases of fracture of the base by decompression operations as advocated lately by Cushing has never appealed to me, perhaps because I have never given it a fair trial.

If the symptoms of increased intracranial pressure are due to hemorrhage outside the dura or in the membranes, decompression might give just enough leeway to prevent a fatal pressure, but in these cases the fracture itself often permits of sufficient hemorrhage to accomplish the same purpose, and if the hemorrhage is within the brain the damage is already done and the relief of pressure on the outside cannot restore the function of the destroyed area or prevent the secondary softening. For myself, therefore, I believe that fractures of the base should not be subjected to the additional risk of operation.

In making a diagnosis of fracture there are but one or two points

of importance that are not obvious, on careful inspection, after getting an accurate history of the sort of traumatism and the onset of symptoms.

These are, in simple fractures, to distinguish between a true depression and the indurated margins of a simple hematoma of the scalp. After one has been once misled by this indurated edge with its soft center, as I have been, he will never forget to look for it. Even then it is not always easy to recognize it. Its regularity of outline, with a soft center, taken in connection with the character of the instrument which inflected the traumatism will, however, usually suffice to prevent an unnecessary operation—experience does the rest. The important thing is to remember that a simple hematoma may be very deceptive.

Another point in diagnosis is the use of lumbar puncture as a means of establishing the laceration of brain tissue; a bloody fluid means hemorrhage and laceration, with or without fracture, and at the same time is a means of relieving intracranial pressure. It should never be overlooked as a means of clearing up a doubtful diagnosis and especially of discriminating between simple concussion and extensive cerebral injury.

Of the daugers and complications incident to these fractures of the skull the immediate are hemorrhage and sepsis. Hemorrhage is to be controlled by operation except in the case of fractures of the base where it seems to be distinctly advantageous, and is never profuse enough to endanger life. Sepsis, with its accompanying meningitis, is fortunately rare in the accidents of civil life, because we usually get at the cases early, before infection has time to occur—and if it does occur, is usually evidence of too long delay before operation or of faulty technique.

The dangers and complications which are late manifestations are paralysis, mental defects and epilepsy. When these are the result of destruction of brain substance by the trauma, little can be done by way of relief. The removal of foreign bodies including loose spicules at time of operation, closure so far as possible of defects in the dura and a careful toilet of the wound, to limit as far as possible scar formation and adherence of dura to bone and scalp, will do much to lessen the probability of their occurrence.

When at operation the depressed fragments of bone have been elevated and all loose and sharp spicules removed, look carefully at the condition of the dura; if it is dark or cloudy and does not pulsate, make a small nick in it to determine presence or absence of subdural hemorrhage.

I once operated on a man who had become insane after a blow on the head with a hammer, whose insanity was marked by periodic outbreaks of great violence ending in convulsions. Eighteen months after the

injury I found a blood cyst, or old localized hemorrhage, in the subdural space, the evacuation of which was followed by complete relief from the outbreaks of violence and the convulsions, and by an improvement in his mental condition sufficient to enable him to return to his home. The cure, of course, was far from complete, but the important lesson to be derived from the experience is that evacuation or drainage of that hemorrhage, at the time of the injury, would have avoided all of the subsequent trouble. So if the dura is clear and pulsating do not open it, but if you are in any doubt, nick it, and if hemorrhage is present, drain it.

As regards rules for operating, I will simply state briefly those which I have derived from my own experience and which I try to follow:

1. In all cases of localized pressure, as determined by localized symptoms of paralysis or cortical irritation, operate.

2. In every suspicious border line case, determine condition of bone over suspected area by exploratory incision of scalp.

3. In every depressed fracture simple or compound, with or without symptoms, elevate.

4. In all depressed or perforating wounds remove all sharp spicules of bone that can be felt loose or detached in the wound; leave the edges of the bony opening and the under surface of the skull around it clean and smooth.

5. Remove foreign bodies always if they are likely to cause infection, or if they are giving rise to symptoms—in other cases, *e. g.*, in case of small bullets, remove when possible without too much traumatism to the brain, remembering always that the possibility of such becoming harmlessly encysted, is better than the certainty of destroying important cerebral centers.

I have thus sketched in a very imperfect and, I fear, very tiresome way, some of the general principles underlying the care of head injuries in civil practice. To bring the picture down to date and to illustrate its application to the problems which our surgeons in the field will have to face, I venture to ask your indulgence for just a moment while we mention some of the problems which have arisen in the practice of our allies during the present war.

One of the most important and most frequent questions that appear in the journal articles of the last two years is: Where shall the operation be made? How near the front?

England, France and Germany agree that operation should be done as soon as possible after the receipt of injury, but they are equally insistent upon getting the wounded back at least to the evacuation hospital if it can be done. After operation they should not be moved again until convalescent, so that if they are primarily evacuated to a field ambulance or field hospital nothing should be attempted there

except the shaving, scrubbing, trimming and dressing. They should then be immediately evacuated to a more quiet and permanent hospital where operation should be done at once if indicated.

The next question is, how extensive should the first operation be? Here the English and German are inclined to be rather conservative, while the French are much more radical—all agree that the first thing to be done is to trim off any crushed and infected tissue, so that the danger of sepsis, which is rendered much greater than in civil life by the nature of the wounds and the delay in transportation, may be minimized.

If received at an evacuation hospital the French advocate doing all that is necessary at once—even to removal of foreign bodies. This latter is accomplished after careful X-ray localization by the use of the little finger and a gall-stone scoop, the wound is closed without extra dural drainage and dural defects closed by pieces of fascia or with rubber tissue. Personally, I should much prefer the latter.

The English and Germans lay the same stress on thorough removal of devitalized and infected tissue and on closure of wound with only extra dural drainage, but are much less inclined to remove deep-seated foreign bodies unless indications, *i. e.*, symptoms, are very clear. Sergeant and Holmes found the late results of those wounded, evacuated to hospitals, in England so good that they recommended only such surgical interference at the front as may be called for to establish necessary drainage and the healing of the wound.

It seems to me that the two points of view are not very far apart after all. Whenever possible, the foreign body should be removed, and this is the more important in war injuries because, as Von Eiselberg points out, while an extensive experience in peace time has taught that projectiles in a large percentage of cases heal in without reaction, since the war began it has been the experience that, in the majority of cases, the projectile causes a local abscess which can be avoided by early removal.

One form of wound not often met with in civil practice is the tangential wound caused by a glancing blow from projectile of high velocity. The peculiar danger of it arises from the fact that without injury to the outer table of the skull, the inner table is often badly shattered; such wounds must, therefore, be carefully explored and the skull trephined.

An interesting work, in the way of reconstruction, has been done by the French in filling up defects in the skull with pieces of cartilage taken from the cartilages of the ribs; a shaving one-sixteenth to one-eighth inch thick taken from the rib cartilage, its full width and length if possible, is placed in the defect.

THE CASE FOR THE MORE EFFICIENT TREATMENT OF LIGHT CASUALTIES IN MILITARY HOSPITALS

By Major ROGER I. LEE
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ONE of the essentials of a military hospital, whether at the front or at the base, is its elasticity. While theoretically every sick and wounded soldier well deserves to be cared for in a hospital bed, in a hospital ward, yet practically at the time of military activity this is impossible. Furthermore, many of the wounds and the ailments of the soldier are so trivial that hospital ward treatment, as it is usually understood, is not necessary.

From my own observations in British base hospitals in the summer of 1915, and since the 30th of May, 1917, I am led to the conclusion that in the British hospitals the serious case is admirably looked after. He is given a bed in a ward, he receives the best surgical skill, adequate nursing, and every possible consideration, subject only to the inevitable discomforts of transportation and care in the war zone. Under the circumstances his condition could hardly be improved. However, one cannot fail but be impressed by the fact that the best medical and surgical skill and the best nursing are devoted to the care of men who will very likely be cripples, certainly physically and probably economically, for the rest of their lives. From a military point of view, these men are as a rule of no future value. Of course every standard of humane consideration demands that those who have become maimed in the service of their country should receive every possible attention, and this should be begrudged by no one.

On the other hand, the lightly wounded case, and the case with a trivial medical ailment, may be looked upon as unworthy of the best medical and surgical skill, in comparison to his more seriously sick or wounded brother soldier. This same tendency exists of course in civil practice. It is obvious that for military purposes the slight casualty, either medical or surgical, is a real asset, and the promptness of his return to active service will go far to increase military efficiency. In most of the hospitals in busy times these light cases are sent to so-called "Crisis Extension Wards," which amount to barracks either in wooden huts or usually under canvas. The supervision of these cases is often delegated to a junior medical officer. The customary method of procedure is to send such cases to a convenient wooden hut or tent where they are dressed or treated.

The purpose of this communication is to try to point out the advan-

tages of a first-class department devoted to the diagnosis and treatment of these so-called "light cases." I think that the experience in our hospital (Harvard, U. S. A. General Hospital, B. E. F.) is fairly typical. We have several crisis extension tent wards capable of accommodating several hundred patients. We started out with the system which we inherited, namely, of having a junior medical officer in charge of each one of these several wards, and another junior medical officer, who, in addition to other duties, undertook the burden of the dressing tent, which was generally regarded as a chore. Cases were sent in a somewhat haphazard fashion to this so-called dressing tent, where wounds were examined and dressed. There were no facilities for even the most minor operations, and inadequate facilities for more than routine simple examination and simple dressing.

As time has gone on the importance of these so-called "light cases" has impressed itself upon us so much, that now the extension wards are under the charge of the Head of the Medical Section, and the Head of the surgical section has, as one of his most important duties, the supervision of the dressing tent. Here he is found at definite hours during the day and personally examines and prescribes with great care for many cases, while supervising all the work there. Many cases, apparently trivial, turn out to have not only retained foreign bodies and fractures, but very severe infections. The danger of gas infection and tetanus is, of course, always present. Certainly there is wisdom in devoting the best possible skill and experience to the greatest number of cases, and to the cases that are of the greatest military value. However, in general, this has not been recognized, and usually inadequate facilities are provided for the necessary thorough treatment of these cases, which is essential for the prompt restoration of a large body of men to active service. A man with boils, or with a small sluggish, granulating wound, or with a trifling medical disorder, adds one to the hospital list and subtracts one from the list of the available fighting force just as much as the man with a shattered leg. Furthermore, incorrect decisions as to the disposal of cases mean delays in the return of fighting men, or useless transportation to the front and back to a hospital.

It would seem, therefore, that a proper solution would be to have what is known, at least on the Atlantic seaboard in the United States, as an out-patient department, especially designed and adequately officered for the treatment of these cases. It must be remembered in this connection that, after all, a military hospital is a combination of ward and ambulatory patients. In contrast to civilian hospitals, one frequently sees, in the same wards, patients who are critically ill or seriously wounded and those who have little the matter with them, and who in

civil life would be treated in an out-patient or dispensary department.

It would seem wise to recognize this fact as has been done in many of the large civil hospitals, and to have a somewhat distinct, but at the same time closely related, out-patient or dispensary department for ambulatory patients. By this distinction it would be possible to concentrate special ward attention on the very sick and on the seriously wounded, and likewise, by the furnishing of adequate facilities, to care for effectively ambulatory patients, who are of so great value from a military and economic viewpoint. The ambulatory patients could be adequately housed in barracks with a minimum requirement for nurses and orderlies.

This would mean the establishment of an out-patient or dispensary department in connection with every hospital. It seems to me that this should be as thoroughly done as the establishment of an operating pavilion, etc. The out-patient department should be commodious, built of wood, with adequate light and heat if necessary. It should have adequate facilities for the dressing of all wounds. There should be a room for minor operations, such as the opening of boils, small abscesses, and the removal of subcutaneous foreign bodies. This, in itself, would prevent the overcrowding of the main operating pavilion, which is now inevitable in times of pressure. There should be opportunity for complete physical examinations. The various specialists should have compartments or rooms for their use. I refer now to the dental department, the eye, ear, nose and throat departments. At present they are usually crowded into the operating pavilion, yet the patients treated there are nearly always ambulatory. There is much more reason that these specialists should be, as in civil practice, concentrated in the out-patient department. Furthermore, there might well be special accommodations for neurological and other examinations, and even for limited laboratory examinations.

Our experience has indicated to us that the usual X-ray equipment in the base hospital is hardly adequate to take care of both the severe cases and the light cases. Yet, in connection with the light cases, the determination of the presence or absence of a fracture or foreign body is often the deciding point as to the disposal of the case. It would be well to consider the establishment of an X-ray plant, of relatively small capacity, in direct connection with the out-patient department. This would add greatly to the efficiency of the organization.

It has now been recognized that the medical man works much more rapidly and much more efficiently when the patients come to him, where he has adequate assistance and adequate facilities and all his tools. The tendency in the past has been to have the medical man go to the patient.

It would doubtless increase the efficiency of any hospital organization, as well as enable the organization to care for more patients, if as many of the patients as possible could see the medical officer in a central, well-equipped place. Many of the patients who are in wards could be seen to better advantage, from a point of view of rapid handling and efficient treatment, if they were treated in this proposed out-patient department, than if they were treated in the wards.

I would propose, then, the establishment of a suitable out-patient department in connection with each military hospital, whether at the front or at the base. The scope of the out-patient department would be governed naturally by the size of the unit and by the type of case treated by the given unit. It should, however, form an important integral part of the organization, just as important as the operating pavilion. It should be designed to provide for the examination, treatment and dressing of a large number of patients in a relatively small space of time. This number would be presumably from 5 to 20 per cent of the total number at the base, and higher as one nears the front line of activity.

In addition to the facilities for surgical dressing, there should be accommodations for minor operations, for the usual medical examination, and for special examinations and treatments, such as eye, ear, nose and throat. It would be of considerable advantage if this department had its own X-ray plant, and even a small routine laboratory.

Inasmuch as cases here treated are of the greatest military value, and inasmuch as many important decisions as to dispositions have to be made quickly and accurately, the charge of this out-patient department should be delegated to the more experienced men rather than to the junior men.

It is believed that, by the development of such an out-patient scheme, the military hospitals would not only be made much more elastic and capable of caring for more patients, but that the medical and surgical treatment would be better done. It would thus add to the military efficiency, and by the improved facilities of work it could probably be done by a smaller medical personnel, which would release medical officers for other duties.

Such a scheme seems equally applicable to the field ambulance, the casualty clearing station, and to the base hospital.

ANKYLOSTOMA DUODENALE, A SYMPOSIUM

HOOKWORM IN THE ARMY

By 1st Lieut. EUGENE McD. TRABUE, *M. C. N. G., U. S. A.*

A SURVEY FOR UNCINARIA AMERICANA

By Capt. ROBERT A. KIELTY, *M. R. C.*,

AND

Maj. C. W. HAVERCAMPF, *M. C. U. S. Army*

THE hookworm infections of men are almost entirely of two types. ankylostoma duodenale, or old world species, and necator americanus, or new world species, so-called from its first having been reported from the United States, by Stiles. The male hookworm is a little more than one-third inch (9 mm.) long, and the female somewhat longer than one-half inch (13 mm.). The male may also be recognized by its posterior umbrella-like expansion or copulatory bursa, while the tail of the female is pointed. In general the old world species or ankylostoma is slightly larger and thicker than the necator.

Hookworms may be found in the small intestine of man in enormous numbers, they produce their effects by feeding upon the mucosa of that organ. The delicate shelled eggs pass out in the feces and after one or two days an embryo is formed. It seems that the anaerobic condition present in the intestine tends to prevent the segmentation necessary for the formation of the embryo. Therefore, hookworm ova in freshly passed feces never show more than early segmentation, and rarely show more than four segmentations, exceptionally eight, in freshly passed eggs. In the presence of oxygen these ova rapidly develop into larvae, and by the fifth or sixth day can move actively in their sheaths, so that they crawl up blades of grass and can live in this stage for several months. This is the infective stage, in which the larvae bore their way into the skin, the usual mode of infection, but occasionally they enter through the mouth, on vegetables or otherwise. From the subcutaneous tissues they effect an entrance into the lymphatics and veins, go to the right heart, and from there into the lungs. From the alveolar capillaries they pass into the pulmony alveoli, thence up the bronchi and trachea, to pass out of the larynx and down the oesophagus to the stomach, where the larva loses its protecting sheath and in a few days develops a buccal capsul.

After about four weeks the larvae have become adults, usually in the jejunum, where, after fertilization by the male, the production of the egg begins, the adults fastening themselves upon and feeding upon the mucosa and tissues of the sub-mucosa.

As to the symptoms of the disease, they, as in almost all such diseases, vary with and in direct ratio to the extent of infection, *i. e.*, the number of worms present, from a mild to a profound type of anemia and, in later stages, toxemia. The gravity of the infection and benefits derived, almost uniformly, from treatment, may be well emphasized by an instance related to me recently by a physician who has had wide experience in the diagnosis and treatment of hookworm disease.

A patient was brought to his laboratory for diagnosis and treatment; his age was 17, though he had the face and facial expressions of an adult of 35 or 40 years and the body and general physique of a child of seven. The mother related to the doctor that the child had never played as other children, showed not the slightest interest in marbles, baseball or games of any kind, and cared no more for a band or a circus than though it were deaf, dumb and blind. In fact it bordered closely upon imbecility. Following the discovery of hookworm and rigid treatment, improvement was most marvelous. He gained 30 pounds in weight in three months, and nearly 2 inches in height in the same time, becoming bright and active and interested in all that a normal boy is usually interested in. He was then placed in school, in the first grade. At the end of a year and a half he advanced from the first grade to fifth, regaining the development, both mental and physical, lost during childhood on account of the infection.

Another instance occurring in the same locality was that of two brothers, growing young men, living on their father's farm with him. After the father's death the management and much of the actual labor incident to the farm devolved upon the boys. It was, however, a poor attempt they made—crops failed, fences rotted, buildings fell to pieces, machinery rusted and the farm became heavily mortgaged. Soon after this an examination of both the boys disclosed the presence in them of hookworm. Treatment was immediately instituted, with the result that they both became apparently new men. The farm began to flourish, crops were good, fences were kept up, buildings rebuilt, machinery replaced and within a few months the mortgage was entirely lifted.

I relate these two instances of severe hookworm infection, which are authentic, merely for the purpose of illustrating the loss and lack of efficiency, caused by an infection easily curable, except in the late stages, which is so frequently neglected and unrecognized and which, it must be apparent, might seriously impair the efficiency of the soldier, a man in whom the highest possible degree of efficiency is not only of vast importance but is of absolute necessity.

A report of the examination of 3,773 men, composing a regiment of infantry and a machine gun battalion, would be of interest to the profession at large, but is of direct value to those of us especially interested in health conditions in the army.

My examination of the officers and men of the units mentioned impressed me primarily with two facts, first, and this is known to be true of the vast majority of diseases of a chronic nature, the wide variability of symptoms in a given number of cases. Many of those in whom was found both ova and worm presented, upon more or less critical examination, scarcely a recognized symptom of the disease at the time of examination. However, upon eliciting a careful history, an astonishing number of these were found to have been treated, at earlier periods of their lives, for various and sundry troubles. The greater number of these obscure cases gave a history of long periods of so-called dyspepsia and its apparent relief and inevitable relapses, but attended throughout with steady, although slowly progressing indisposition, lethargy, loss of energy, weight and ambition. At this time of examination and discovery of the ova or the worm itself, no outward sign existed to suggest its presence and, had it not been for a careful routine examination, would have progressed, no doubt, finally to a more classical picture of the familiar type, immediately suggesting the presence of the parasite.

The second fact, of more than ordinary interest to me, was that in cases of two or more members of the same family, brothers, under examination, the result was almost invariably the same, namely, that both, or in cases in which there were more than two, all were found to harbor the worm, or all were found to be negative. The family in which were found both positive and negative was the exception rather than the rule. On a larger scale, though with scarcely less variation, the same rule was found to hold good in cases of communities. An excellent opportunity for observation along this line was afforded me in several instances, where two companies were enlisted almost entirely from the same community, which presented results practically parallel. The most notable of these was in case of ———, two companies of infantry from which place were examined, one with total examined of 111. Total positive was 56 or 22.5 per cent; the other, total examined 226 total positive 52 or 23 per cent. Getting to a broader comparison, it is of interest to note that companies from adjoining counties of eastern Kentucky were found to show similar results, all of which leads us to the conclusion that here is a fertile field for work on hookworm eradication. This, however, may be a hasty conclusion in so far as specifying "a particular place" is concerned, for a routine examination of the

inhabitants of other sections might result in the discovery of the existence there of the same condition.

It may be of interest here to note the method pursued in examining the men of the commands mentioned. A laboratory, after a fashion, was equipped and arranged in the regimental infirmary. Four men from the sanitary detachment were selected to prepare the specimens for examination. A letter was written to each company commander and forwarded to the commanding officer of the regiment, requesting that a roster of his company be submitted to me, and that certain instructions regarding the collection of specimens for examination for hookworm be followed carefully. These instructions were sent to him with a sufficient number of boxes to supply his command. The boxes were the ordinary sanitary paper spit cups. The memorandum specified first that each man be given a cup and instructed to write plainly his name and organization upon it, place a small quantity of feces (size of a hickory nut) in it, wrap it carefully and securely in paper, write his full name and organization on the outside and leave it at a place designated by the company commander; second, that he impress upon the minds of the men that these boxes were to be accounted for, used for no other purpose and not destroyed; third, that every effort possible to expedite this work be employed; fourth, that a sergeant be detailed in charge of the work, whose duty it would be to see that each man submitted, for examination, a specimen of his own feces, and that specimens were delivered to the laboratory at 7.00 a.m. promptly.

In the laboratory I instructed three of the men to prepare slides and the fourth to clean them after I had examined them. Not having a centrifuge was a handicap, but having three men at work reduced it somewhat. A small amount of feces was placed in a large test tube, one-third full of water, and shaken until thoroughly emulsified; the tube was then placed in a rack and the sediment allowed to fall, when the more fluid portion was poured off and a large drop of the sediment placed upon the slide. This was spread out to a thin film and was then ready for examination under the microscope, low power being used. After examining the specimen, its corresponding name on the roster was checked and marked either "positive" or "negative," as the case might be. After completing the examination of the command, a list of men who had been marked "positive" was prepared and delivered to the regimental surgeon.

Treatment not yet having been instituted, I am not in a position to enter that phase of the subject, nor report any results obtained.

The tabulated report of examination which includes both the —

Infantry and — Machine Gun Battalion, — Division, U. S. A. is epitomized as follows:

	— *Inf.*	— *M. G. Batt.*
Strength of command	3,417	531
Examined, positive	624	35
Examined, negative	2,672	442
Total examined	3,296	477
Absent from command	69	37
Total accounted for	3,365	514
Unaccounted for	52	17
Total	3,417	531

A SURVEY FOR UNCINARIA AMERICANA

Made in pursuance to instructions from the Surgeon General, of all men from the southern states, in the various commands at ——, has been completed. In view of the findings a report on the work accomplished may be of some value for future similar studies.

Figuring an estimate of 5,000 men to be examined, a tentative scheme was outlined and the necessary supplies were ordered. As these were received they were conserved so that before any actual work was attempted all the necessary apparatus was at hand. This included microscopes, centrifuge, slides, cover slips, labels, centrifuge tubes, sputum and lily cups, wooden spatulas, applicators, wax pencils and office supplies. It was planned to keep six microscopes busy in an attempt to average about 100 specimens a day for each scope. This was found to be possible after the men had been trained.

The preparation of lists of the men to be examined from certain specified states which included Georgia, Florida, etc., was the next step. This was carried out by the company commanders who furnished us with the name, rank, organization and state of each man in their command. The survey prepared duplicate lists by companies, giving each name a serial number—in all, 8,277.

With the exception of the collection of specimens the entire work was carried out by a detail of fourteen privates and one sergeant, who had had previous laboratory training, under the direction of one of us in charge. This detail consisted of intelligent men secured from a base hospital unit in training at this post. To them much credit is due for their adherance to routine and exactness in carrying out the work as outlined. The first day or two was spent in familiarizing the men with

the microscopes, the methods of procedure, the making of drawings, and the preparation of specimen boxes.

Paper sputum cups were folded, labelled and a small wooden spatula placed in each. The latter were obtained by cutting wooden tongue depressors into four parts. Later lily drinking cups were substituted for the sputum cups; on the whole these cups made excellent containers. Questionnaire forms were made by mimeograph.

SPECIAL SURVEY—HOOKWORM

No. ....

LABORATORY, POST HOSPITAL,————————————.

Date of collection....., 1917.
Organization.....
Surname..... Christian Name..... .Rank.....
Home residence..... Residence past ten years.....
Ground itch..... History of barefoot..... History of diarrhea.....
Typhoid fever..... Infestation with hookworm known.....
Previous treatment, type, with dates.....
Privy or flush toilets with surface or sewerage drainage at home and former residence.....

(Do not write below this line)

Results..... Remarks.....
Date and by whom.....

Large boxes were packed for each command containing the serially numbered list, sufficient cups and questionnaires. These were sent out with instructions to each regimental surgeon who was made responsible for the proper collection of the specimens. Every effort was made in this work to obtain coöperation, which was promptly and efficiently given by all officers responsible, materially helping the ultimate success of the survey.

Transportation, furnished by the motor ambulance companies, allowed one member of the detail to stop at every regimental infirmary once a day. The specimens collected were brought to the laboratory. During the height of collection as many as 1,500 specimens were brought in. At this time the detail was well trained so that no specimen remained over forty-eight hours.

Methods of Examination.—The purpose of the survey being to do the most good for the largest number, a method of procedure was adopted to this end. It is realized that some cases were missed, but these were of the lesser grades of infestation and in the aggregate probably totaled a small percentage. Every man of the detail was trained to do every step of the examination. In this way frequent changes broke up the monotony and increased efficiency. A large room in the laboratory

was set aside for this work alone. The work began at one end of the room and was completed by successive stages at the scopes of the other end. Each specimen box was received, labelled with its proper number; a small piece of feces was transferred, agitated with distilled water in a centrifuge tube, and the number marked with a wax pencil. The tube was centrifuged for 15 seconds at 1,500 revolutions and the supernatant liquid poured off. Spreads were made on to slides and cover slips placed on the drop. The latter were used to avoid drying. The slides were numbered with a wax pencil. The preparations were examined and, where positive, were so noted by the number on the slides. When negative, the slides were carefully gone over, the average time consumed being about five minutes. For the first few days all positives were checked and all negative slides examined by the officer in charge. After this it was found that the work of the men could be relied upon, frequent checking proving this to be correct. Mechanical stages were used on the scopes and microlamps for illumination; the latter were an invaluable aid, allowing the work to progress steadily in spite of dark days. One man remained in charge of records during the entire time. Twice a day the slips were checked on to the retained lists and at the end of each day the positives were forwarded by letter to the regimental surgeons with recommendations for treatment. Oil of chenopodium, followed by a purgative on three successive days, was carried out in all cases, with a request for another specimen of feces at the end of three weeks. The record of treatment was returned by letter to the survey, thus affording a check. Where the treatment could not be carried out because of transfer or other reason, every effort was made to reach the man and have this given.

All types of eggs were seen, from the first stages of granular protoplasm through to the formation of the larva within the egg. The latter were very rare, the usual form being the segmented type with an average of 7 or 8 divisions. The oval form was constant, they were often found round; this shape was due to position and could be altered to the oval by putting pressure on the cover slip. Many larvae were found moving in the free state.

Results.—8,277 names of soldiers were furnished to the survey, who had resided in southern states. From this number 6,159 specimens were collected. The failure to collect the exact number was due to many reasons, as transfer, leaves and illness. 1,504, or 24.4 per cent, were found positive for hookworm.

The number of men examined in the different units varied from 1 to 601 and the percentage positive from 0 to 44.1 per cent. The highest, occurring in one of the ambulance companies, had a total examined of

34. The regimental units which had large quotas examined showed a moderate variation from 22.2 per cent to 33.6 per cent positive. The medical officers, out of a total of 108 examined, showed 6.9 per cent positive while the line officers, of a total of 152, had 5.2 per cent positive.

TABLE 1

Cases	*Number examined*	*Number positive*	*Per cent positive*
All diseases	412	79	19.1
Pneumonia	18	3	16.6
Measles	73	13	17.7
Mumps	66	19	28.7
Total	569	114	20.0

All of the cases in the hospital (see Table 1) coming from all of the states of the Union gave a positive of 19.1 per cent; this percentage increased when figured on a basis of the southern states to the general average of 24.4 per cent. 18 cases of pneumonia showed 16.6 per cent, 73 cases of measles 17.7 per cent, and 66 cases of mumps 28.7 per cent positive. 536 men applying at the recruit depot were examined and showed 16.2 per cent positive. Many of the latter men came from northern states.

The number and percentage by states are shown in Table 2. It will be noticed that Georgia led with 23.3 per cent, while West Virginia was low with 0.5 per cent. Mississippi showed a percentage of 4.1 per cent. This is noteworthy, since here much valuable work has been accomplished by the Rockefeller Foundation.

TABLE 2

State	*Number examined*	*Percentage positive*	*State*	*Number examined*	*Percentage positive*
Georgia	351	23.3	Texas	49	3.3
Florida	122	8.1	Arkansas	14	0.93
Mississippi	75	4.9	Tennessee	137	9.1
South Carolina	147	9.1	Virginia	31	2.1
North Carolina	43	2.8	W. Virginia	8	0.5
Alabama	230	15.2	Kentucky	96	6.3
Louisiana	111	7.3			

A few cases from other states were encountered while going over the hospital, as follows: New York, 2; Michigan, 1; Massachusetts, 1; Illinois, 2; Pennsylvania, 4; New Mexico, 1. It is presumed that these men have spent some time in the south, although this was not brought out by the questionnaire. In the case of Pennsylvania it has often been said that certain parts of the coal regions harbor many cases of hookworm. The cases encountered in this survey may belong to such a class.

The results of the question for ground itch were that 552, or 33.5 per cent, of the positive cases and 714, or 11.4 per cent, of the negative cases gave this history. This is about what one would expect and shows the relative importance of such a history.

3,922, or 63.6 per cent, of all cases went barefoot at some time. These are divided up into 1,043, or 69.4 per cent, of the positive cases, and 2,879, or 46.7 per cent, of the negative cases, from which we may conclude that many boys go barefoot without developing hookworm, but out of those who have the disease a proportionately high number go barefoot.

The question of a long-continued diarrhea was asked and the figures obtained show that 246, or 16.3 per cent of the positive cases, gave such a history. From this data it would seem that this symptom is not a prominent factor in hookworm.

The influence of uncinariasis on the incidence of typhoid fever is suggested by the following figures. The positive cases gave a history of typhoid in 227, or 15.0 per cent, while the negative cases gave 705, or 11.4 per cent. This indicates a slight predisposition to this disease. The incidence 932, or 15.1 per cent of the total, gives the figure for potential typhoid carriers in the entire camp. Comparing this with the present incidence of typhoid at this camp suggests the value of anti-typhoid prophylaxis and what might be expected if this procedure were not carried out.

The results of the questionnaire on known infestation gives figures which one might expect. In the positive cases 226, or 15.0 per cent, knew of a previous infestation, while 258, or 17.1 per cent, actually had previous treatment for hookworm. This apparently slightly higher percentage of treated cases may be explained in two ways. The men would be more likely to remember treatment on the one hand and, on the other, there is a prevailing custom, in certain localities, of giving treatment to units of population without examination for hookworm. In the negative cases 370, or 0.69 per cent, knew of an infestation but were not treated, and 502, or 0.8 per cent., had previous treatment. In compiling the statistics on this basis it would seem that a greater percentage had not, than had, been benefited by treatment; but of the total number examined 760, or 12.3 per cent, had previous treatment, 258, or 4.1 per cent, of the positive cases and 502, or 8.1 per cent, of the negative cases. In this way it appears that twice the number of negative cases were benefited by treatment than were not. The latter compilation would seem to be more reasonable. This is just one more evidence of the possibilities in compiling statistics and the relative value to be placed on the figures obtained.

The questionnaire sought the influence of the toilet and drainage factors. The figures on the types of toilet used are interesting. Of the positive cases 847, or 56.3 per cent, used a privy, while 1,980, or 32.1 per cent, of the negative cases did the same; 494, or 32.8 per cent, of the positive cases used a flush toilet, while 1,726, or 31.1 per cent, of the negatives did the same. From this data the conclusion is drawn that more men used a privy than a toilet and that a greater percentage showed up in the positive than in the negative cases.

Parasites other than hookworm were not especially sought after but, when found, were noted. The eggs of taenia and tricocephalus dispar were the commonest. Several eggs were found the identification of which was uncertain. In one case, a severe infestation with hookworm, both the eggs of tapeworm and tricocephalus were found.

During the summer a study of about 250 examinations for hookworm was made of the student medical officers from the M. O. T. C., Camp Greenleaf, at the suggestion of the commanding officer, Colonel Page. In conjunction with the fresh preparations for eggs, dried smears were stained for tubercle bacilli according to the method used by one of the writers.[1]

Hookworm eggs were not demonstrated in a single instance from this group. Most of the men examined were from northern states. Other eggs were encountered, including circomonas intestinalis, ascaris lumbricoides, oxyuris vermicularis and taenea saginata. One case of larva and eggs of strongyloides intestinalis was found. This officer had a chronic malaria and experienced great difficulty keeping up with the training. After a concentration of treatment, however, he was very much improved, the change preventing the necessity of what would have otherwise been a discharge from service.

Most of the men in this group of officers were fresh from home, and the change of their mode of life was well seen in the character of the feces. A high percentage were liquid, indicating a diarrhea, quite a few showed large numbers of pus cells and much desquamation of epithelium. These specimens were obtained during very hot weather, the men had a tendency to overeat and, as a consequence, nearly every slide showed digestion incomplete. As the officers became acclimated these conditions cleared up. The specimens stained for tubercle bacilli were examined with the idea more of obtaining a group of negatives than of positives. The slides were carefully examined from one end to the other and acid-fast organisms, tinctorily and morphologically resembling the tubercle bacillus, were found in two instances. Both

[1] Keily, Robert A.: Hydrochloric Acid as a Decolorizing Agent for the Tubercle Bacillus. J. A. M. A., Vol. LXVI, pp. 1619, 1620.

officers failed to show any physical signs of the disease, but their general makeup suggested the possibility of an old process.

Discussion.—The importance of this survey lies not in the interesting data obtained, but in the final results attained by treatment. Every aid given to the physical welfare of the fighting man will make the percentage of the fighting units efficiency that much greater. We have heard the word *efficiency* used in so many places that we almost wish we would never hear it mentioned again. Still, it is the motto which should be held constantly in front of every man's eyes so that he will not only increase his own efficiency, but his every act will increase the efficiency of his neighbor and in this way make the efficiency of the unit just that much higher.

In the insidious nature of the infestation with hookworm, which takes the stamina out of the individual, which makes him a thin, stoop-shouldered, anemic skeleton, ready to receive any infection coming along, and once infected leaves him without combative resistance, lies the importance of a survey for its eradication.

Conclusions.—(1) 6,159 examinations of feces for uncinaria eggs were completed; 1,504, or 24.4 per cent, were found positive.

2. The work was accomplished in less than a month by a detail of fifteen enlisted men with the coöperation of regimental surgeons in the collecting of specimens and the administration of treatment.

3. Oil of chenopodium was used in approximately 5,000 doses without untoward manifestations.

4. Reexamination of all the positive cases, three weeks after treatment, is now in progress and indicates that good results are to be looked for.

5. A second treatment has been given in a few cases and a third and fourth is contemplated, until all cases are cleared up as nearly as possible.

6. The outcome of such a survey should result in a more efficient fighting force, a diminished susceptibility to contagious disease among the men and an increase in resistance, should infection be contracted.

AN AUSTRIAN RESERVE HOSPITAL

By First Lieutenant GEORGE J. KORBY

Medical Reserve Corps, United States Army

(With sixteen illustrations)

IT WAS the writer's good fortune to have seen service in the largest military hospital in Austria-Hungary and perhaps the largest in the world, devoted entirely to the care and treatment of wounded soldiers, and the following is a brief description of this immense institution and the methods employed in handling the wounded from the time of their arrival in hospital until their discharge from same.

The K.u.k. Reserve-spital No. 2 is in Pardubitz, a city of twenty thousand population, centrally located in the great agricultural region of Bohemia, distant 200 miles from Krakow, near the northern Russian Austrian border, and about 400 west of Lemberg, with good railroad facilities.

The hospital was built during the first and second years of the present European War and contains 10,000 beds. It was constructed on the barrack plan with 50 beds to each barrack and is divided into five sections or divisions of 2,000 beds each, with a regimental or division surgeon, ranking as captain, in command of each section. The chief surgeon and commander of the entire hospital was of general rank (Generalstabsarzt Majewski).

Three of these sections were used for surgical cases only, and the other two for medical, genito-urinary, orthopedic and other specialties. The facilities for laboratory research work in pathology, bacteriology, vaccine therapy, etc., were quite complete. Each surgical section was provided with a complete X-ray laboratory for radiographic and fluroscopic work and one or two operating houses, each with two operating rooms completely equipped.

Each section also had its separate kitchen, pharmacy, dressing rooms, and disinfecting and sterilizing plants, administration buildings, and quarters for the hospital staff, *i.e.*, the doctors, nurses, orderlies, etc.

The hospital had a central laundry, electric light, sewage, garbage and incinerator plants, together with water supply, fire department, telephone and telegraphic systems.

The construction was of wood, with a composition roofing of felt impregnated with sand and tar; each ward, about 150 feet long, 24 feet wide and 10 feet to the eaves, was electric lighted, stove heated (burning wood or coal), with shower and tub baths, flush closets and a wash room at each end of the ward. In the center of each was the kitchen, to which

all of the patients' meals were carried in bulk, from the large kitchen, and here distributed to the sick. Here also were prepared all extra and special diets. The linen room, nurses' quarters and doctors' office (serving as dispensary, drug room, and record room) were also located here in the center. Entrance was gained to the ward by a door at each end and one mid-length, facing the middle entrance of the next adjoining barrack. The beds were the simple iron-frame hospital bed, provided with straw mattresses for the slightly wounded. Those wards housing the severely wounded were provided with spring and soft cotton felt mattresses, and also fracture beds.

The operating houses, laboratories, kitchens, laundries, disinfecting houses, etc., were of brick and concrete and were steam heated. Most other buildings were of wood and stove heated.

The arrival of a detachment of wounded, its size, number of bed and ambulatory cases, and where from, were usually announced from four to ten hours before it was due in station. This allowed ample time to prepare for its reception and the cleaning and heating of the depot or station. There were three depots for the hospital, most conveniently located. The assignments of quarters to patients were made according to the character and nature of the wounded and the available vacant beds in the particular section at which the transport was unloading. Usually new cases were kept together, and this was made possible by condensing older patients, after discharges and transfers, thus completely vacating one or more wards.

Ordinary Austrian transport trains were made up from the small passenger cars and more often box or cattle cars converted into a hospital train, with beds or litters temporarily placed for the wounded. The Hungarian tourist cars made excellent hospital trains. These trains came directly into the hospital depot and here the detraining or unloading took place. If the weather permitted, the patients were given hot coffee and rolls, and occasionally cigarettes, immediately after removal from train. They were then brought into the depot reception room, divested of all clothing and given a blanket to cover themselves with, after which they were made to visit the barbers in an adjoining room, who hurriedly clipped both hair and bear with electric clippers. The wounded were then brought into the bath room and the slightly wounded or ambulatory cases given a shower bath, assisted by husky orderlies or attendants supplied with soap and a good stiff brush resembling a curry comb. The more severely wounded, though still ambulatory, such as those with wounds of upper extremities, head, or shoulders, were given a tub bath. The severe bed cases were laid on wooden slabs, wherever possible and here cleansed.

Following the bath and general clean up, the pubic and adjacent regions were smeared with a germicidal solution, after which the patient was given his hospital clothes, duck pajamas, and take to the dressing room, through the checking room, where he was identified by his identification tag and history card given him in field hospital, and assigned to his particular ward. In the dressing room every dressing, splint and cast was removed and the wounds cleansed and again dressed. The diagnosis was here made, or the previous diagnosis confirmed, and noted on the slip bearing the soldier's name and ward number. Cases with dirty, lacerated, multiple wounds of the extremities were given an injection of antitetanic serum, wherever a previous injection had not been given, or no positive statement of such was noted on history.

Very little surgery was attempted in the dressing room, as time was limited and, usually, there were too many wounded to be taken care of. When the patient was redressed and cared for, he was placed on a litter, supported on a two-wheeled cart, and thus transported to his designated ward and put to bed. The very badly infected cases which required immediate incision for drainage, the occasional patient with a gas infection, or a case with badly lacerated and fractured limb, where an amputation was necessary to save a life, were taken care of immediately and made as comfortable as possible.

Cases which, upon examination, proved to be other than surgical were transferred to their respective sections and wards. A detachment of 800 wounded, including 350 bed patients, was treated in the above described manner in August, 1916, in four hours.

Immediately after the last patient was disposed of, the ward surgeon made his rounds and inspected every new case assigned to him, noting its general condition and carefully looking for any secondary hemorrhage. A tourniquet was always handy, in fact if hemorrhage from a wound of any limb was anticipated, the tourniquet was placed loosely about the limb, and the nurses and attendants instructed to immediately apply same when bleeding was noted and then telephone for the ward surgeon. Should this or any other emergency occur during the night, the medical officer of the day was first called, and after examining the patient he would consult the surgeon whose case it happened to be. One medical officer of each section of 2,000 beds was always on duty; he slept at night in quarters provided for the officer of the day and responded to all night calls.

Every patient received a light diet for the first twenty-four hours. On the morning of the day following arrival, the ward surgeon, during his usual rounds, specified the different diets, prescribed medication and designated which patients were to be dressed in the wards by the nurses

Birds-eye View of Portion of K.u.k. Reserve-spital No. 2, Pardubitz, Bohemia.

Exterior View of a Single Barrack.

To face page 300.

Hospital Laundry.

The Disinfecting House of Section V of K.u.k. Reserve-spital No. 2, Pardubitz, Bohemia.

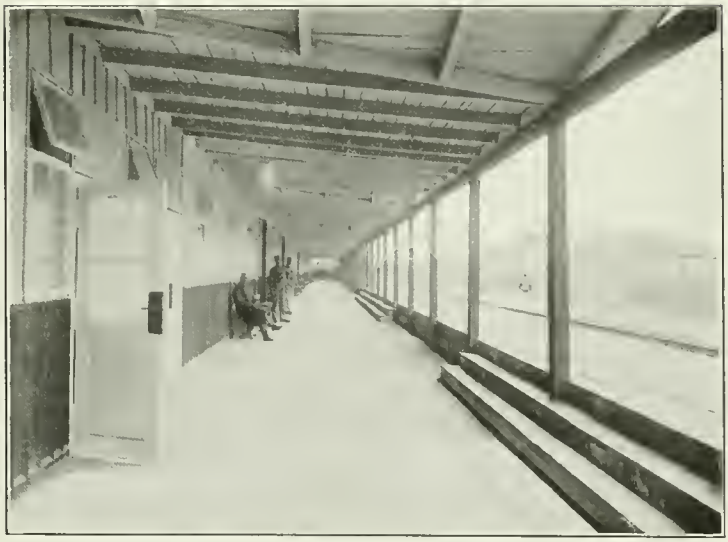
Hospital Canteen.

Hospital Postoffice and Telegraph Station.

A View of the Hospital Depot from a Distance.

A View of the Hospital R. R. Depot Connected with the Adjoining Barrack Which is the Dressing Room.

Unloading a Hungarian Transport Train.



Front View of the R. R. Depot.

One View of the Bath Room.

Interior of the Dressing Room Adjoining the Depot.

Interior of the Dressing Room while the Wounded Are Being Cared For.

The Interior of a Barrack Showing Wounded Turks—Mostly Fractures.

Interior of a Barrack Showing the Slightly Wounded.

Some of the Hospital Staff

and attendants. The more severe cases were always dressed by the doctor, in the dressing rooms preferably; but when the patient was too weak to be moved, or had extension applied, or for some other reason could not be moved, he was dressed in the ward.

All cases in which the projectiles had not been removed, or were suspected of not having been removed, were scheduled for X-ray, as were most fractures, where the nature and extent of injury were not clear. The morning round was to be completed by 9 o'clock, by which time all diet and drug reports or sheets were to be made out and signed by the attending surgeon. The operative cases were taken care of between 9 o'clock and noon. The afternoon was spent in doing dressings, supervising the construction and application of splints, casts and extensions, and doing such minor surgery as was indicated.

In the case of penetrating wounds, where the projectile had not been removed and which caused no loss of function or did not interfere with the process of healing, it was not disturbed. Local anesthesia was used wherever practicable. Clean surgery, and especially bone surgery, was impossible in every case, for, without exception, no case handled by our unit was received with the wound or injury uninfected. Peroxide of hydrogen and 4 per cent solution of aluminum acetate were the most commonly used antiseptics for dressing and irrigations. Dakin's solution was tried but with faulty technique, in preparation and application, produced unsatisfactory results. However, in the K.u.k. Reservespital No. 8 in Vienna, with better perfected methods, the results obtained were more favorable.

The history of each case was carefully written up by a clerk who was assigned to each surgeon and who wrote what was dictated by the surgeon himself. Until the winter of 1916 histories were written in duplicate, but later this was discontinued, probably to reduce the paper work to a minimum. Each history contained in brief on one side (front) the patient's name, weight and height, nativity, nationality, occupation, civic condition, nearest relative, date and place of enlistment, length of service, and the diagnosis of present injury or disease. On the opposite side appeared, first, the anamnesia, including date and place of injury and whether injury was caused by rifle, grenade, cannon etc.; previous treatment, nature, dates and place where received Second, the diagnosis of present injury or disease. Example—perforating wound of lower leg, with or without fracture, or penetrating wound of left thigh, projectile removed or not removed. Third, the status praesens; condition of patient, nature and location of wound briefly but fully described, as same appeared on date of admission. Fourth, the treatment, stating what treatment had been rendered, and notes on the

condition of wound and patient from time to time. All operations were carefully noted in detail. Laboratory reports with dates were included. Fifth, when ready for discharge from the surgical section, the patient's condition was again noted, whether or not any loss of function was present, and the surgeon's recommendation for further treatment, together with date of this last examination and the signature of the ward surgeon.

Before discharging a patient it was essential that the wound or injury be completely healed, and this being so, to determine whether or not he was fit for service. On certain designated days all such cases were ordered for inspection and examination by the regimental or division surgeon, and he decided what their disposal should be and where they were to be sent Example, if patient had a slight ankylosis he was ordered to receive orthopedic treatment. If he had a suspected nerve lesion, he was ordered to the neurologist for his examination and report. If the patient had no loss of function and had fully recovered from the injury, he was ordered to a concentration camp, there to remain for two or three weeks and then be sent back to the front or firing lines.

The question of operating on a patient without his consent, if such involves danger to life, has been discussed in this country, as in Europe. In the Austrian Army I have observed, during a period of one year in actual service in Bohemia and in Vienna, that a soldier is seldom subjected to a major operation if he himself refuses to consent thereto. The following example may illustrate this point. A patient comes to the hospital with an injury which is but a slight wound of some soft tissue; on examination it is found that he also has a complete inguinal hernia. An operation is suggested and advised but the patient refuses. This refusal is noted on the history sheet, as is the refusal of any patient for any prescribed treatment, and nothing further is done. However, when a patient's life is in danger and the saving of it depends upon an operation, his consent is not always obtained nor, under these circumstances, considered necessary.

A case I have in mind, and which I shall never quite forget, illustrates the questions of the advisability of operating upon a patient, without his consent and against his will. In November, 1916, we received a large detachment of wounded Turkish soldiers, among whom were three badly wounded and gas infected cases. An amputation was advised for all three patients, two of whom consented and permitted the amputation of the leg above the knee, thus saving their lives and making an uneventful recovery, with a good stump for an artificial limb. The third, a young Turk, absolutely refused and, with tears running from his eyes, begged to be spared an operation, saying that he understood perfectly the seriousness of his condition as explained, and was satisfied

to die rather than submit to mutilation, even though death was apparently certain to follow, and perhaps was only a few hours away. After consultation with Turkish officers, interpreters and division surgeon, operation was decided on without the consent of the patient. He was immediately prepared for an operation and the leg was amputated between the middle and upper third of the thigh. Ether anesthesia was administered. Early on the following morning the patient died.

It may be asked what effect on the morale and keenness for fight of the enlisted personnel would such have, when it becomes generally known that a fellow soldier died following an operation, consent to which was refused by himself? Should the man be permitted to decide, when often a major operation is absolutely indicated and perhaps the only possible chance to save life? The question of operating without the consent of the patient is difficult to decide and no definite rule should be laid down to govern all cases. I am informed that the consent of the patient is required in the United States Army, in all cases.

Consent for a major operation, in my opinion, should be obtained in all but exceptional cases, the exceptional case being that of an absolutely ignorant person or one who, as a result of the injury, or explosion of shot, or loss of blood, is temporarily unbalanced in mind and not fit mentally to judge for himself, and one who may be unconscious when seen by the surgeon. In this view our rule seems too rigorous and inelastic.

The diets for patients in the military hospitals are the "usual" and "special" of the prescribed "diet-list." The "usual" orders of the diet list have "one," "two," "three," and "four" forms, and these forms are detailed in the following list (*A*).

The "one" form consists of milk for breakfast, broth with croutons for dinner and supper. Patients of the "second," "third," and "fourth" form receive for breakfast one of the soups (Nos. 2, 3, and 4, diet-list *A*), for dinner one of the soups named under (Nos. 6, 7, and 8); "two", form has in addition veal or lamb stew (No. 9), or roast meat (Nos. 10 to 14) and two vegetables (Nos. 16 to 24 and Nos. 33 to 39). The "third" and "fourth" forms have in addition to soup, boiled beef (No. 15) and two vegetables (Nos. 16 to 36).

Supper for "second," "third," and "fourth" forms consists, like the breakfast, of one of the soups (Nos. 2, 3, and 4, diet-list *A*), "four" form receives in addition one of the dishes named under Nos. 44 to 51.

Bread rations are given according to Nos. 52 to 53. "Special" diets include foods and drinks which may be prescribed in addition to the four regular forms of diet. "Diet-list" *B*, special orders, shows how far admissible this is to the four different forms.

Diet List "A"—"Usual Orders"

No.	Articles	Measure or weight of Diet-form I	II	III	IV
	Breakfast				
1	Milk.....cc.	150	.....	.....	.....
2	Soup of brown flour with croutons, cc.	.....	250	250	250
3	Farina or millet soup.....cc.	.....	250	250	250
4	Potato soup.....cc.	.....	250	250	250
	Dinner				
5	Soup with croutons.....cc	200	.....	.....	.....
6	Soup with farina or barley.....cc.	.....	200	.....	.....
	Soup with rice or sago.....cc.	.....	200	200	200
7	Soup with nudels or rice.....cc	.....	200	200	200
8	Potato soup.....cc	.....	200	200	200
9	Veal or lamb stew.....gm.	.....	110	.....	.....
10	Roast veal.....gm.	.....	110	.....	.....
11	Roast beef.....gm.	.....	110	.....	.....
12	Roast lamb.....gm.	.....	110	.....	.....
13	Roast pork.....gm.	.....	110	.....	.....
14	Roast venison.....gm	.....	110	.....	.....
15	Boiled beef.....gm.	.....	.....	100	100
16	Sauerkraut.....gm.	.....	125	250	250
17	Beets.....gm.	.....	125	250	250
18	Turnips.....gm.	.....	125	250	250
19	Carrots.....gm.	.....	125	250	250
20	Spinach.....gm.	.....	125	250	250
21	Cabbage, sweet.....gm.	.....	125	250	250
22	Lettuce, cooked.....gm.	.....	125	250	250
23	String beans.....gm.	.....	125	250	250
24	Mashed potatoes,.....gm.	.....	125	250	250
25	Potatnes in brown sauce.....gm.	.....	.....	250	250
26	Cabbage with cauliflower.....gm.	.....	.....	250	250
27	Peas.....gm.	.....	.....	200	209
28	Lentils, beans.....gm.	.....	.....	200	200
29	Peas, mashed.....gm.	.....	.....	200	200
30	Peas with barley or rice.....gm.	.....	.....	200	200
31	Beans with barley or rice.....gm.	.....	.....	200	200
32	Farina.....gm.	.....	.....	200	200
33	Rice, plain or with sauce.....gm.	.....	100	200	200
34	Dumplings, plain or with sauce...gm.	.....	145	145	145
35	Nudels or macaroni, plain or with sauce.....gm.	.....	150	200	200
36	Boiled potatoes.....gm.	.....	200	.....	.....
37	Creamed potatoes.....gm.	.....	200	.....	.....
38	Stewed dried fruits:				
	Pears.....gm.	.....	200	.....	.....
	Apples.....gm.	.....	180	.....	.....
39	Stewed fresh fruits:				
	Apples and pears.....gm.	.....	175	.....	.....
	Prunes and cherries.....gm	.....	200	.....	.....
	Supper				
40	Broth with croutons.....cc.	200	.....	.....	.....
41	Browned flour soup with croutons, cc.	.....	250	250	250
42	Farina or millet soup.....cc.	.....	250	250	250
43	Potato soup.....cc.	.....	250	250	250
44	Nudels.....cc.	.....	.....	.....	200
45	Macaroni.....gm.	.....	.....	.....	200
46	Bread pudding.....gm	.....	.....	.....	200
47	Farina pudding.....gm.	.....	.....	.....	200
48	Milk, rice or farina.....cc.	.....	.....	.....	200
49	Meat stew with dumplings.....gm.	.....	.....	.....	87
50	Gulyas with potatoes.....gm.	.....	.....	.....	87
51	Meat with rice.....gm.	.....	.....	.....	75
	Rolls and Bread				
52	Rolls for dinner.....gm.	.....	100	.....	.....
	and supper.....gm.	.....	100	.....	.....
53	Bread, mixed flour:				
	Dinner.....gm	.....	.....	250	250
	Supper.....gm.	.....	.....	250	250

DIET LIST "B"—"SPECIAL ORDERS"

No.	Articles	Measure or weight of Diet-form I	II	III	IV
1	Milk.....cc.	200	200	200	200
2	Milk-coffee.....cc.	150	150	.....	.....
3	Black coffee.....cc.	150	150	.....	.....
4	Tea.....cc.	150	150	.....	.....
5	Chocolate.....cc.	125	125	.....	.....
6	Cocoa.....cc.	100	100	.....	.....
7	Broth.....cc.	200	200	.....	.....
8	Broth with croutons.....cc.	200	200	.....	.....
9	Gruel.....cc.	200	.....	.....	.....
10	Wine-soup.....cc.	125	125	.....	.....
11	Hash, fine.....gm.	100	100	.....	.....
12	Veal or lamb stew.....gm.	100	100	.....	.....
13	Chicken, preserved, cans.....	½	½	.....	.....
14	Chicken, broiled, cans.....	.....	½	.....	.....
15	Roast veal or beef or lamb, or pork, or venison with sauce.....gm.	.....	110	.....	.....
16	Veal-cutlets.....gm.	.....	125	.....	.....
17	Ham.....gm.	80	80	.....	.....
18	Eggs, no.....	1–2	1–2	.....	.....
19	Nudels pudding.....gm.	150	150	.....	.....
20	Farina pudding.....gm.	150	150	.....	.....
21	Nudels cooked.....gm.	150	150	.....	.....
22	Bread pudding.....gm.	150	150	.....	.....
23	Farina, millet.....gm.	150	150	.....	.....
24	Macaroni.....gm.	150	150	.....	.....
25	Milk-rice pudding.....gm.	150	150	.....	.....
26	Nudels in milk.....cc.	150	150	.....	.....
27	Steamed rice.....gm.	125	125	.....	.....
28	Boiled potatoes.....gm.	.....	215	.....	.....
29	Stewed fruit.....gm. Prunes, 180–190 gm. Apples or pears, 200–200 gm.	190	190	.....	.....
30	Stewed fresh fruit, plums, cherries. gm.	200	200	.....	.....
	Apples, pears.....gm.	175	175	.....	.....
31	Lettuce in vinegar.....gm.	.....	75	75	75
32	Potato salad.....gm.	.....	200	200	200
33	Cole slaw or endive salad.....gm.	.....	100	100	100
34	Roll, white bread,.....gm.	100	100	.....	.....
35	Milk roll.....gm.	50	50	.....	.....
36	Wine, white or claret.....cc.	125	125	125	.....
37	Beer.....cc.	250	250	250	.....

The above diet-lists, with their different varieties of food, furnish an efficient aid in prescribing a suitable dietary provided the articles are obtainable. Towards the close of 1916 and especially in the early part of 1917, when the "food shortage problem" was most serious, much of the suggested food was difficult to obtain and in fact some of it had entirely disappeared from the markets.

GUNSHOT FRACTURES OF THE LONG BONES OF THE EXTREMITIES

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(With fourteen illustrations)

ONE of the most interesting problems with which a surgeon deals in a base hospital is that of the treatment of fractures of the arm, forearm, thigh and leg. As admitted to this hospital, they have comprised a little more than half of all fractures. No two cases are alike. The varieties of flesh wounds, the different types of infection and the variations in position and severity of the fractures render to each case an individuality of its own, making it a study of unfailing interest.

Within the scope of this paper it would be impossible to consider these fractures in all their aspects. For instance, the most interesting and by far the most difficult fractures are those which involve the joints. Yet the joint complications constitute in themselves an extensive study much too large for discussion here. Likewise the nerve injuries, with the attendant nerve surgery and orthopedic treatment for permanent paralysis, present specialized problems. This paper will be confined, therefore, to a consideration of compound diaphysial fractures, touching not at all upon joint complications, save in the quoting of statistics, and only slightly upon nerve injuries. It is intended to consider first the varieties of fractures commonly seen, then to touch lightly upon the ballistics of projectiles in relation to the types of fractures produced and, finally, to deal with the treatment of fractures and their complications.

Diaphysial injuries as a whole may be divided into three classes: (1) contusions; (2) incomplete fractures consisting of grooves, fissures, penetrations and perforations; and (3) complete fractures caused by the contact, penetration or perforation of projectiles.

Contusions (Fig. 1).—These are the least serious of bone injuries. So slight are the symptoms which they cause that very frequently they are detected only by the radiograph. They may be produced either (1) by direct impact, as of a spent missile, such as a deflected or undeflected bullet, shrapnel and shell fragment, whose velocity is so much reduced that the soft tissues check its momentum—or of very small fragments which have insufficient weight to penetrate the bone cortex; (2) by tangential impact, the missile actually grazing the periosteum; or (3) by the vibratory effects of missiles traversing the adjacent soft tissues at a high velocity, The lesions are essentially periosteal, consisting of lacerations of varying degrees and of abrasions or contusions with or

without subperiosteal hemorrhages. The cases with subperiosteal hemorrhage are most easily diagnosed on account of the localized pain. In those cases arising from vibration, petechial hemorrhages into the bone marrow may occur.

Incomplete Fracture.—As already indicated, these consist of grooves, fissures, penetrations and perforations. Occasionally one may meet with uncomplicated types of each, such as a simple groove, a longitudinal fissure with contusion of the bone, a simple penetration by a small shell fragment and rarely a complete perforation of the bone shaft. As a rule they occur in combinations of fissures with grooves, penetrations or perforations.

Grooves (Fig. 2) occur most frequently along the prominent ridges of the long bones, such as the crest of the tibia, the epicondyles of the humerus, the linea aspera and the edges of radius and ulna. At these points they may be without complications, especially if shallow, for the thickness of the bone is so little that not enough shock results to produce fissures. If the grooves are deeper, or if they are produced along the cortex of the broad surfaces of the bone shafts, fissures are more apt to develop. Depending upon the striking force of the missile, these fissures may extend only an inch or two longitudinally or they may extend obliquely across the shaft, a complete fracture resulting. A prominent characteristic of grooved fractures, when caused by missiles that perforate the limb, is the simple nature of the wound of exit. The outward track of the missile is small, containing possibly a small amount of bone-dust. There is not the laceration of muscle and skin that is seen in the more severe fractures. The deeper grooves may involve the marrow, exposing it to infection.

Fissures are the *sine qua non* of complete fractures. In gunshot injuries they show very definite tendencies as regards the direction in which they extend, dependent upon the force with which the missile strikes. The simplest types are observed in cases of contusion where the striking force of the missile is the least that will cause bone injury. Here the fissure extends longitudinally along that portion of the shaft opposite the point of contact of the missile (Fig. 3). If the missile is directly impacted against the bone shaft, the fissure will develop in a plane parallel to the direction of the missile. If the missile contuses the bone by tangential contact, the fissure will extend in a plane perpendicular to the direction of the missile. As the striking force increases, the fissures tend to multiply and to extend obliquely from the point of contact around the shaft, meeting on the opposite side the longitudinal fissure just described. In this way fragments are separated and fractures of the various degrees of comminution are produced. Fissures vary in

length from 1 to 4 inches and show a marked tendency to stop at the epiphyseal lines.

Penetrating (Fig. 4) and *perforating* (Fig. 5) incomplete fractures are caused by small shell fragments, in the one case lodging in the marrow, in the other passing entirely through the shaft. In both, longitudinal fissures are apt to occur. Of the two, penetration is much more common. In fact, so great is the striking force required that perforation of the diaphysis without a complete fracture is rather rare. Occasionally one meets with a superficial perforation, resembling a very deep groove except for the lateral extrusion of a thin fragment of cortex, which juts in hinge-like fashion into the soft tissues (Fig. 6). In common with deep grooves, penetration and perforation are the most severe of the incomplete fractures, in that they expose the bone marrow to infection.

Complete Fractures.—These are produced in four ways—by the contact with, penetration or perforation of, the bone shaft by the smaller missiles, or by the smashing blows of the larger missiles. They occur either at the point of impact or at a distance of several inches, and, accordingly, they may be designated as direct or indirect.

The so-called contact fractures may be caused by missiles of a low or high velocity. In the former case the missile is impacted against the cortex or glances off it; in the latter case it perforates the limb, grooving the cortex in transit. The low-velocity missiles have been, in my own experience, of the following order of frequency: shell fragments (by far the most frequent), shrapnel balls (intact or split), the core or casing of disintegrated bullets, and deflected or spent bullets. Of the high-velocity missiles, the bullet has been the most frequent, then the shrapnel ball and shell fragment. Fractures from contact are the simplest of the complete fractures. They are characterized by the simplicity and fewness of fissures and by little loss of substance. Their fragments are large, with pointed extremities and usually adherent. The periosteum may be intact, save at the point of contact, or split along the lines of fissure. These fractures may be divided into three main types: (*a*) the transverse and oblique, or two-fragment fractures; (*b*) the "wedge-shaped," or three-fragment fractures; and (*c*) the "butterfly" or four fragment fractures.

(*a*) *Transverse and Oblique Fractures* (Figs. 7, 8, 9) are quite similar to those seen in civil practice. They are characterized by a single fissure and no extruded fragments. In number they are the least frequent of the direct fractures, occurring only occasionally in the larger bones, rarely in the smaller. They are caused generally by a missile which strikes a glancing blow, gouging a well-defined groove in the cortex. Less frequently they may arise from a direct impact.

FIG. A.—COMPOUND FRACTURE FIBULA.
Focus of fracture blown away by high velocity bullet.
Note proliferation of tibial periosteum resulting from vibratory contusion.

FIG. 1.—BONE CONTUSION FROM SMALL SHELL FRAGMENT.

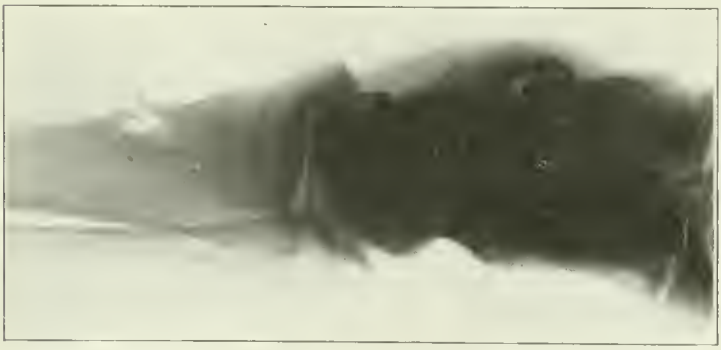

FIG. 2.—GROOVE OF TIBIA.

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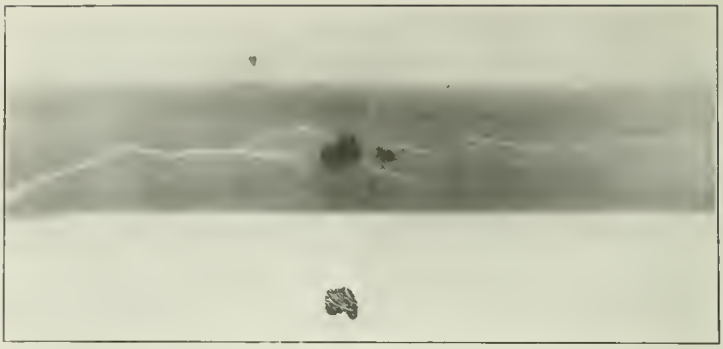

Fig. 3.—Oblique Complete Fracture of Femur, Illustrating the Great Length of Fissures.

Fig. 4.—Incomplete Penetrating Fracture Head of Tibia, with Formation of Single Long Fissure.

Fig. 5.—Incomplete Perforating Fracture Tibia, with Slight Fissuring.

FIG. 6.—DEEP GROOVED FRACTURE TIBIA. PRACTICALLY A SUPERFICIAL PERFORATION.
Note thin layer of cortex bridging the gap; also the area of osteomyelitis above.

FIG. 7.—DIAGRAM OF TYPES OF COMPLETE CONTACT FRACTURES.
1. "Butterfly." 2. "Wedge-shaped," from eccentric contact. 3. "Wedge-shaped," from direct central contact. 4. Oblique. 5. "Butterfly," with subdivision of lateral fragments by short fissures.

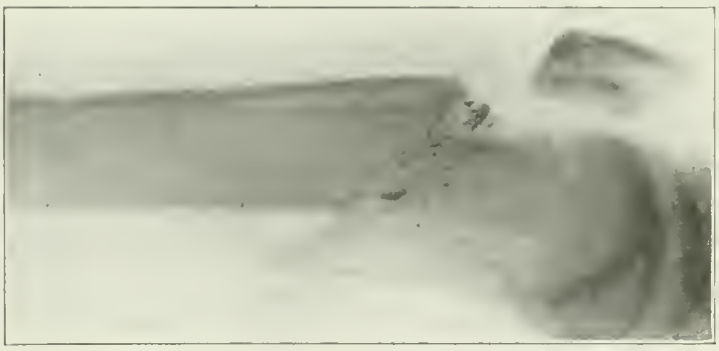

FIG. 8.—OBLIQUE FRACTURE OF FEMUR, DIRECT.
Note that tip of lower fragment is pointed, while that of upper fragment is blunted by the grooving of the missile.

FIG. 9.—COMPOUND FRACTURE HUMERUS. OBLIQUE, WITH TENDENCY TOWARD "WEDGE-SHAPED" TYPE. THIS CASE HAD AN INDIRECT TRANSVERSE FRACTURE 3 INCHES LOWER.

FIG. 10.—"WEDGE-SHAPED" CONTACT FRACTURE HUMERUS FROM DEFORMED, DEFLECTED BULLET.

FIG. 11.—COMPOUND FRACTURE TIBIA. PENETRATING SHELL. BONE CAVITY FILLED WITH "BIPP." ILLUSTRATES "BUTTERFLY" TENDENCY OF FISSURES.

Fig. 12.—Complete Contact Fracture of Ulna, of "Butterfly" Type.

Fig. 13.—Incomplete Grooved Fracture of Upper Third of Humerus. Oblique Indirect Fracture of Middle Third.

The upper and lower fragments have pointed extremities with no loss of substance save at the site of the groove where the fissure starts. All indirect fractures are transverse or oblique.

(*b*) The "wedge-shaped" fractures (Figs. 7, 10) are the result, as a rule, of eccentric or glancing blows, with grooving of the cortex. From the point of contact, fissures extend obliquely upward and downward around the farther aspect of the shaft until they merge into the longitudinal fissure of the opposite side. In this way a wedge-shaped fragment is separated laterally. The completion of the fracture is produced in one of two ways: if the blow has been glancing, by the resulting groove; or if more central and direct, by a fissure which extends from the point of impact obliquely or transversely about the nearer side of the shaft, merging with the longitudinal fissure. Thus three fragments are produced, an upper, lower, and lateral. Pointed extremities, adherent periosteum and little loss of substance are characteristic of them.

(*c*) "Butterfly" fractures (Figs. 7, 11) are produced by the direct impact of a low-velocity missile. From the contact point four fissures extend obliquely upward and downward and about both sides of the shaft, merging with the longitudinal fissure behind. A complete fracture results with the lateral extrusion of two wedge-shaped fragments (Fig. 12). Thus four fragments are formed, an upper and lower, both V-shaped, and two lateral.

As already indicated, these are merely the main types of contact fractures. The transverse and oblique, when they occur, are of course of a perfect type. It does not often happen, however, that a missile strikes with just the required force and at the proper angle to produce "wedge-shaped" or "butterfly" fractures of perfect type. Usually the striking force is excessive, with the result that the lateral fragments are subdivided by accessory oblique or transverse fissures. Never, however, do they approach the stage of comminution. In the worst of contact fractures the tendency toward one of the two latter types can be easily distinguished.

Penetrating and perforating complete fractures differ from the contact fractures not so much in the direction in which the main fissures extend as in the greater degree of fragmentation, the extrusion of nonadherent fragments, and the loss of bone substance. They are lesions produced by missiles of a greater striking power and naturally are more severe.

Of the two, the penetrating fractures are the less extensive. With the smaller missiles, such as shell or grenade fragments and disintegrated shrapnel or bullets, the bone lesion may be typically "wedge-shaped" or "butterfly," differing from the contact types merely in the

fact that the cortex at the site of impaction is "punched in" over an area roughly of the size of the contact surface of the missile and is lodged together with the missile in the bone marrow. Spent bullets, directly penetrating with their sharp points and acting as wedges, may produce perfect "butterfly" fractures. With larger missiles, however, the bone is comminuted. Many of the smaller bone fragments are non-adherent, stripped of their periosteum, and ultimately necrose in the presence of infection, with varying degrees of loss of substance as a result. The common X-ray picture of such a fracture is that of a smash, the projectile lying in the midst of a mass of irregular fragments. In a few a tendency to conform to the two latter contact types is evident; in others it cannot be detected.

Complete perforating fractures exhibit, as a rule, the greatest amount of comminution and loss of substance of all fractures. The degree of comminution is dependent upon two factors, namely, the size of the bone shaft and the striking force of the missile. The greater the diameter of the bone, given missiles of equal striking power, the larger and fewer will be the fissures and, consequently, the larger, fewer and more adherent the fragments. The greater the striking force of the missile, given bones of equal size, the shorter and more numerous will be the lines of fissure, hence the smaller, more numerous and less adherent the fragments. It follows that as the striking power of missiles increases, the focus of fracture becomes more localized, with greater degree of comminution. In any given fracture, where the focus is not actually swept away, the progressive increase in the size of the fragments, as their distance from the track of the missile becomes greater, is readily distinguished. Thus along the track bone-dust will be found, and as one examines the fragments farther away they will be found to increase in size, becoming largest at the periphery of the focus.

With missiles of the minimum requisite striking force, perforation fractures may grossly resemble, as regards lines of fissure, the "wedge-shaped" and "butterfly" contact fractures. The missile does not perforate the shaft by pushing aside the bone substance with a wedge-like action, but drives the bone before it, more in the fashion of a punch. The orifice is rounded, approximately of the size of the missile, while the exit is larger, produced not only by the missile but by the bone from the orifice which has been set in motion as a secondary projectile. The exit is generally demarcated by fissures which give it roughly a quadrangular or triangular shape.

As the missiles increase in velocity, the fractures become more irregular, with greater comminution. More of the bone is carried away as

secondary projectiles. These tend to diverge and, if of sufficient velocity, help form the explosive exit wounds of the soft parts. They may even perforate the skin at some distance from the exit wound of the missile. Occasionally, in the smaller bones of leg and forearm, the whole focus is swept away, leaving a definite gap in the bone shaft (Fig. A).

Those fractures, caused by very large shell fragments and grenades bursting close at hand, follow no type. They are merely severe smashes, with excessive shattering of the bone-shaft and severe laceration of the soft parts. Early amputation is their usual fate.

Indirect Fractures.—These differ from the direct in being caused, not by the impact of the missile, but by the sudden violent pressure exerted upon the shaft. They occur at distances of 2 to 6 inches from the wound and are essentially simple. As already indicated, they are either transverse or oblique. Three types may be observed. In the first and more usual, the indirect fracture occurs in the same bone as the direct, and distal to it. There have been at least three such cases at this hospital, all of them occurring in the humerus, the direct fracture being in the upper third, the indirect in the lower half (Fig. 23). The second type may be seen in forearm and leg fractures, consisting of the direct fracture of one of the bones, generally tibia or radius, with indirect fracture of the other bone. The third type is not often seen. It consists of a direct fracture of forearm or leg with an indirect fracture of arm or thigh. There has been one case of this nature here—a direct fracture of the tibia and fibula with an oblique indirect fracture through the supracondylar portion of the femur.

Ballistics.—There is no intention of considering in detail the question of ballistics, but merely of touching upon it in its relation to the causation of the different types of fractures. The missiles with which we are concerned may be divided into two main groups: (1) the primary, such as bullets, shrapnel balls and fragments of shell or bomb; (2) the secondary, such as fragments of wood, stone or metal which are put into motion by shell or bomb explosions.

The modern bullet is an elongated missile, ogival or conico-cylindrical in shape, with sharp or rounded nose, weighing 10 to 15 gms. Its caliber is roughly one-quarter of its length (7 m.m. : 30 m.m.). Its metal may be homogeneous throughout, such as the brass French bullet D, or may be composed of a hardened lead core surrounded completely by an envelope of steel, nickel or copper in various combinations. Its initial velocity, or the distance it would travel in one second if unaffected by air resistance, ranges from 570 to 860 meters. Its remaining velocity gradually diminishes from air resistance and may be stated as follows, taking the French D bullet as an example: at 400 m., r.v. =

536 m.; at 600 m., r.v.=470 m.; at 1,000 m., r.v.=365 m.; at 2,000 m., r.v.=210 m. The range is about 3 kilometers (1). In the course of its flight the bullet tends to turn upon its long axis in spite of the rotation imparted to it by the grooves of the rifle barrel. This is due probably to air pressure exerted upon a missile rendered unstable by having its center of gravity somewhat behind the mid-point of its axis. The deflection may amount to a third in 600 meters, with the result that the missile may strike sideways or base first. The bullet is also liable to deflection by ricochet. It is stated by Delorme[1] that one-third of all wounds are caused by ricochetting bullets. These bullets may also be deformed or disintegrated. Delorme quotes Journée in the statement that a velocity of 750 meters is necessary for deforming a jacketted bullet.

Shrapnel balls are rounded, made of hardened lead; diameter 10 to 16 mm., weight 10 to 12 gms. They are contained in shell cases, to the number of 200 to 350. The bursting charge is placed mostly at the base of the shell, so that on exploding the shrapnel balls are propelled forward at an increased velocity, dispersing in cone-shaped fashion. Three-inch field-gun shrapnel at a range of 6,500 yards has an initial velocity of 865 feet per second: the sum of the remaining velocity of the shell (565 f.s.) and the increased velocity conferred by the bursting charge (300 f.s.). At 3,000 yards the area of dispersion is about 400 yards in length and 150 yards in width, with a central zone, 25 yards in diameter, in which the velocity is at its maximum (2).

Shell fragments are derived from the disintegration of shell cases by explosion into hundreds of small fragments, weighing 5 to 300 gms. Very large fragments are derived from the base, fuse or ogive. The velocity of the fragment is roughly that of the shell: at 1,000 m., 422 m.; at 2,000 m., 346 m.; at 3,000 m., 300 m.[1] Two types of shell are used: (*a*) those bursting in the air by time-fuse, for the destruction of men; (*b*) those bursting by percussion, for destruction of men and material. Taking a 3-inch time-fuse shell as an example, the fragments will number about 600, with an area of dispersion about three-quarters that of shrapnel.[2] Percussion shells are most deadly in the immediate vicinity of their explosion, not only from their own fragments but from the secondary projectiles which are set in motion. The area of dispersion of shell fragments, as well as shrapnel, will vary with the bursting height. The lower the shell bursts the smaller will be the area of dispersion and the greater the velocity.

Bomb fragments resemble those of percussion shells in their localized zone of action. They are as a rule smaller. Their velocity is great close at hand, but diminishes rapidly. Secondary projectiles likewise rapidly

[1]Delorme: War Surgery, 1915.
[2]LaGarde: Gunshot Injuries, 1914.

lose their velocity, though the initial velocity may be great enough to cause severe injury.

Missiles may be said to have an active power and a penetrative power. Their active power is dependent upon two factors, weight and velocity. The equation of active power is expressed thus: $P=\frac{WV^2}{g}$ (Delorme). It follows that the missiles with the greatest velocity and weight will have the greatest striking power. Their penetrative power depends not only upon their striking power, but also upon the resistance of the tissues. It is at once evident that, given missiles of equal weight and velocity, the tissues will offer most resistance to that missile which presents the largest striking surface; in other words, the largest caliber. That missile will have the least penetrating power. It is this latter power which determines the destructive action of a missile upon bone.

Holding in mind these factors of penetrative power, it becomes evident that the undeflected bullet is the most destructive of the smaller missiles. Its velocity is greater at all distances. Its active force, according to Delorme, may be expressed in kilogrammeters as follows: at initial velocity, a.p.—330 kgm.; at 100 m., a.p.—230 kgm.; at 300 m., a.p.—145 kgm.; at 500 m., a.p.—95 kgm.; at 1,000 m., a.p.—55 kgm.; at 2,000 m., a.p.—25 kgm. Its caliber is small, thus enhancing its penetrative power. It has been estimated by Laurent[3] that the following active powers are necessary for certain degrees of injury: for traversing 4 to 7 men, 304 kgm.; for traversing 3 to 6 men, 176 kgm.; for explosive effects, 128 kgm.; for fracture, 16 kgm.; for disabling a man, 8 kgm.; for contusion, 2 kgm. These figures apply to undeflected bullets. In accordance with these effects, three zones of action have been designated: (*a*) the explosive zone, within the first 500 m. of the trajectory, in which the bullet exerts the maximum power, having a divulsive and propulsive effect upon the tissues; (*b*) the zone of perforation, at a range of 500 to 2,000 m., in which the bullet acts as a wedge, dividing the tissues without explosive effect; (*c*) the zone of contusion, at a range of over 2,000 m., in which the active power is at its minimum, resulting in only slight injuries.

Deflected bullets, though they may have the same active power, have a lesser penetrative power than the undeflected, in that they present a larger surface to the resistance of the tissues. Likewise shrapnel and shell fragments of equal weight have less power of penetration than bullets. Not only is their initial velocity less, but their caliber may be greater. Their velocity moreover, diminishes so rapidly that at the periphery of the zone of dispersion their effects are far removed from those of bullets. The larger shell fragments, at the beginning of their

[3]Laurent: La Guerre en Bulgarie et en Turquie, 1914.

flight and in the center of the dispersion zone, have an excessive active power, dependent upon their preponderance in weight. Their penetrative power, though diminished by their large caliber, is yet sufficient to enable them to produce severe lacerations. Grenade fragments, being small and quickly losing their velocity, have little penetrative effect at a distance. Close at hand, from their multiplicity and closeness to each other, they may have severe disruptive effects. The secondary projectiles are the least penetrative of all missiles, in that they have a comparatively low initial velocity and a large caliber. Close at hand, if of excessive weight, they may have severe lacerating effects.

Keeping clearly in mind these varying penetrative powers, the causation of the different bone injuries may be deduced. Undeflected bullets, in the explosive zone, will produce severely comminuted complete fractures, with propulsion of fragments and explosive exit wounds, if they strike the bone shaft directly; grooves, with complete contact fractures, if they strike glancing blows—the more glancing the blow, the less comminuted the fracture; and contusions, from grazing or vibration, when passing through the adjacent soft tissues. In the zone of perforation they may cause complete comminuted fractures without propulsion of fragments, complete perforating fractures with little comminution, resembling the "butterfly" type, or incomplete perforating fractures with longitudinal fissures—when striking directly; complete fractures of the "wedge-shaped" type, when striking a glancing blow; simple grooves and contusions. In the zone of contusion they may cause complete or incomplete penetrating fractures when striking directly; grooves and contusions when striking eccentrically.

Deflected bullets in the explosive zone will produce excessively comminuted fractures with severe laceration of the soft parts; in the perforation zone, contact fractures with considerable comminution and laceration at the nearer ranges, diminishing rapidly with increasing range; in the contusion zone, grooves and contusions.

Shrapnel balls and the smaller shell fragments, in the center of their dispersion zone, may produce severe comminutions with moderate propulsion of fragments, when striking directly; grooves with complete contact fractures when striking glancing blows; simple grooves and contusions. The very small shell fragments may penetrate or perforate the bone without complete fracture. In the outer portions of the zone, they produce complete contact fractures, both penetrating and perforating, incomplete penetrating fractures, grooves and contusions. The larger shell fragments, in the central zone, produce severely comminuted fractures, with excessive laceration of the soft parts. In the outer areas of dispersion, they produce complete contact fractures, with laceration, or contusions.

Grenade fragments, close at hand, may cause extensive comminution and severe laceration. At a distance they produce incomplete penetrating fractures, grooves and contusions. The secondary projectiles, at short range, produce effects similar to those of shell fragments. At a distance they cause only slight contact fractures, grooves or contusions.

The treatment of compound gunshot fractures resolves itself into the supression of infection, the postural treatment of the fractured bone and the prevention or rectification of complications.

The infection of compound fractures is of course more complicated than that of ordinary flesh wounds. It is a combination of infection of the soft tissues and of bone. That of the soft tissues, though primarily it may be most severe, is as a rule quickly subdued. In the bone it is more resistant, leading frequently to successive re-infection of the soft tissues. It is the infection of the soft tissues that immediately endangers life. It is the bone infection that, through chronic suppuration and constant re-infection, subsequently endangers life. The treatment of infection of the soft parts is often the chief initial problem, for not only is life endangered but no adequate postural treatment of the bone can be carried out until the swelling and pain have been relieved.

Nature of Infection.—In every wound infection a definite evolution is evident. From the clinical aspect, three stages will be observed—the pre-inflammatory, the inflammatory, and the suppurative. The pre-inflammatory stage extends through a period of 12 to 48 hours after reception of the wound—during which there is no discharge; the adjacent tissues have neither swelling nor redness and there is no temperature. Then begins the inflammatory stage, continuing for 2 to 3 weeks—during which the wound discharges freely, the adjacent tissues are swollen, reddened and painful, and the temperature is raised. The wound discharge undergoes a definite change. It is at first reddish-brown, thin and foul, suggestive of broken-down blood-clot. As time passes it gradually becomes whiter, thicker and less foul and finally frankly purulent. The soft tissues likewise change their aspect, gradually losing their inflammatory signs as the discharge becomes purulent. The suppurative stage has begun and continues until the infection is cured. The discharge remains purulent. The infection of the soft tissues becomes localized to the track of the missile constituting a definite sinus to the site of the fracture.

From the bacteriological aspect, wound infections may be divided into four stages. There is first the quiescent stage, corresponding to the pre-inflammatory, during which the bacteria, both anaerobes and aerobes, exist only in patches along the track of the missile and about any foreign bodies that are lodged there. They are not in sufficient

amount to cause inflammatory reaction. From about the second day until the end of the first week, the discharge begins to increase, reddish-brown and foul. In it the spore-bearing anaerobes and streptococci predominate. From the end of the first week until the end of the third, a period of transition exists in which the anaerobes gradually decrease and the pyogenic organisms relatively increase. After the third week the discharge is frankly purulent with the predominance of streptococci, staphylococci, coliform bacilli, etc., and only a few anaerobes[4].

There are several factors which influence the nature and degree of infection. The chief external factor is the high impregnation of the soil with fecal organisms. Consequently skin, clothing and missiles may become contaminated. Of twelve samples of clothing examined by Fleming,[4] ten contained *B. aerogenes capsulatus*, four contained *B. tetani*, five contained streptococci, and two staphylococci. It follows that the wound may be infected by missiles which have been contaminated by skin, clothing, or, in the case of ricochet, by soil; by particles of clothing that have been carried into the wound; by secondary projectiles, or by extension inwards from skin or clothing. The chief internal factor in infection is the degree of laceration of the tissues. It may be considered a maxim that the degree of infection is directly proportional to the degree of laceration. With extensive wounds there is always destruction of muscle and fascia, and the combination of necrotic tissue, blood-clot and infected foreign bodies affords a most favorable medium for the growth of infection. Taylor[5] has proven experimentally that the implantation of cloth infected with aerobic and anaerobic organisms results in a more extensive infection than the implantation of the organisms alone; that the substitution of dead muscle for cloth causes an even more extensive infection; and that the combination of dead muscle and cloth gives rise to the most severe infection of all.

Holding in mind these factors, it is easy to determine the part which the missile plays in the infection. The undeflected bullet of reduced velocity is the least likely to introduce infection. It has had no previous contact with the soil. It does not carry the clothing along with it. It causes small skin wounds and, in accordance with its lack of explosive power and the moderate degree of the fractures produced, but little laceration of muscle and fascia. Shrapnel, shell and grenade fragments, and secondary projectiles of reduced velocity, will as a rule introduce a certain amount of infection, in that they tend to punch out particles of clothing and carry them into the wound, and moreover, with the exception of shrapnel, may have had contact with the

[4]Fleming: *The Lancet*, September 18, 1915.
[5]Taylor: *Annals of Surgery*, December, 1916.

ground; but this infection will not ordinarily be of intense nature, as there is but slight laceration. It tends to be limited to the tissues in immediate proximity to the track of the missile. Undeflected bullets of high velocity may produce badly lacerated wounds which will become severely infected from skin and clothing. Likewise, ricochet bullets, shrapnel and the various fragments, when of high velocity, may produce severely infected wounds from the combination of laceration, contamination from the soil and introduction of clothing.

As already indicated, the usual evolution of wound infection is toward the pyogenic stage. The simplest type of pyogenic infection is manifested in wounds of slight laceration with small skin apertures. There is a slight adjacent inflammatory reaction and only a moderate discharge of pus. Often the skin wounds heal, resulting in a localized abscess. With increasing degrees of laceration, the infection becomes more severe, extending along the numerous clefts that are opened, and involving the adjacent tissues in more and more severe phlegmonous inflammation with glandular reactions and constitutional symptoms. Such infections are generally amenable to treatment and do not constitute a serious menace to life.

Under suitable conditions, however, the anaerobic organisms which, as already shown, predominate in the early stages of infection, may gain the ascendency and produce infections which immediately endanger life. The conditions which favor most their onset may be summarized as follows: the retention of bloodclot and wound discharges, the presence of devitalized or necrotic muscle and fascia, extensive comminution of bone, prolonged contact with the wound of blood-soaked dressings or clothing, and interference with circulation by injury of blood vessels or constricting bandages. Thus there is provided an ideal medium under anaerobic conditions, in tissues whose vitality is lowered by shock and by a diminished blood supply. The resultant infections are of two types: those arising (*a*) from gas-producing organisms, and (*b*) from the bacilli of tetanus.

Gas Infection.—The malignancy of gas infections, in common with those of pyogenic origin, is inversely proportional to the degree of localization. There are three types which are well localized, quickly amenable to treatment and devoid of severe constitutional effects. The first of these occurs generally in a punctured wound. It is manifested by a scanty, foul, brownish discharge, bubbling with gas, and by a restricted area of cellulitis as evidenced by subcutaneous crepitation. The second takes the form of a gas abscess, developing about a lodged foreign body, with a closed skin wound. The third type is localized to a muscle or small group of muscles, such as the anterior tibials or peroneals. Gas infection does not tend to spread from in-

jured to uninjured and healthy muscles. Hence the infections of this type remain localized and are easily treated.

The more severe types may develop in either muscles or subcutaneous tissues, or in both. They are much more extensive, more progressive, and produce menacing constitutional effects. The first of these may be termed a gaseous cellulitis. There is an extensive, rapidly progressing involvement of the subcutaneous tissues. They become swollen and tense, crackling on pressure, and on section exude lymph-like fluid and gas. If arising in the proximal segments of the extremities, this infection may rapidly involve the trunk, in spite of treatment, with resultant blood infection and death. A more severe type occurs in the larger groups of muscles, such as those of thigh or calf, which have been extensively lacerated. The area involved becomes swollen, tense and possibly tympanitic. Pain is at first severe, referred to the muscles involved, but as they necrose it dies away. The infection may extend along the vascular sheaths and outwards to the subcutaneous tissues. If the muscles are in a position to exert pressure upon an important blood vessel, it may be occluded, with necrosis of the area it supplies and extension of the infection thither. In this way, by occlusion of the femoral or brachial arteries, massive gangrene of the distal segments may result.

The most malignant of all gaseous infections is that which produces massive gangrene of the extremities. It is associated with severe muscle laceration and is due to interference with the circulation, either from primary injury to the blood vessels or from their occlusion by increasing gaseous pressure. It generally develops in two or three days after injury, but, on the other hand, may occur within a few hours or only after several days. Within ten hours it may progress to a fatal conclusion. It is a common experience for a limb to be transformed over night from a condition of apparent health to a state of advanced gangrene, with fulminating general symptoms. Two types of massive gangrene are observed, dependent upon the precedence of either the local signs and symptoms or of the constitutional. In one type the general symptoms precede the local. Rapid toxaemia develops, leading to a fatal conclusion before the limb has become gangrenous. Nausea and vomiting begin; the pulse becomes rapid and of low tension; the skin is cold and moist. There may be a sense of well-being until death; or if in the terminal stages pain develops in the swelling limb, the mental state may become that of muttering delirium. In the other type the local symptoms precede the general. Severe pain sets in. The limb becomes swollen, tense and tympanitic. Subcutaneous crepitation is usually a late development. The pulse in the extremity is gradually obliterated. The skin becomes purple, then dark green and

black, and may be the site of extensive bleb formation. As the gangrene advances, the limb becomes cold and numb, and the pain ceases. General symptoms supervene. In some cases these are restlessness, delirium and unconsciousness; in others the mental faculties remain unclouded and there is a sense of well-being until death. The pulse becomes rapid and feeble; the skin, "clammy"; the respirations increase; the temperature is often sub-normal, particularly as dissolution becomes imminent; rarely is it much raised. The blood may become infected, with the development of gas bubbles, leading to cardiac churning and distress. The abdomen may become distended, with onset of vomiting and hiccoughing. High leucocytosis, decreased alkalinity of the blood and haemolysis have been reported. Death results from cardiac failure or gas embolism. At post-mortem examinations degeneration of the cells of the brain cortex, liver and adrenals and intestinal hemorrhages have been found.

Tetanus.—The nature and course of tetanus is much the same as in civil practice. In contrast to gaseous infections, it may develop in the most innocent-looking wounds and is not dependent upon severe lacerations. On the other hand, it may be exacerbated by a severe concomitant pyogenic or gaseous infection. The type with generalized symptoms is common; in addition there are many cases with only a slight trismus or tetanic spasms localized to a muscle or group of muscles. The mortality has undergone a marked reduction since the beginning of the war. Of 179 cases reported in the British overseas forces up to July, 1915, the mortality was 78.2 per cent.[6] Of 231 cases occurring in home hospitals from August, 1914, to July, 1915, the mortality was 57.7 per cent.[7] Of 195 cases occurring from August, 1915, to July, 1916, the mortality was 49.2 per cent.[8] Of 200 cases from August to October, 1916, the mortality was 36.5 per cent.[9] Of 100 cases from October to December, 1916, the mortality was 31.0 per cent. Thus there has been a gradual decline of 47.2 per cent up to last December.

The rule that the shorter the incubation, the greater the mortality has obtained. Of the 195 cases last mentioned, those with incubation periods of ten days or less showed a mortality of 81.5 per cent; those of 11 to 25 days, 52.2 per cent; those of over 26 days, 27.2 per cent. In the last hundred cases reported, symptoms were distributed as follows: general, 61, with 34 per cent mortality; local, 28, no deaths; doubtful, 11, with 91 per cent dead. 35 infected fractures had 11.4 per cent and 65 infected flesh wounds, 41 per cent mortality.

(*To be continued*)

[6]Sloggett: Memorandum—Treatment of Injuries in War, July, 1915.
[7]Bruce: *British Medical Journal*, October 23, 1915.
[8]*Ibid.*, *The Lancet*, December 2, 1916.
[9]*Ibid.*, *The Lancet*, September 15, 1917.

THE REACTION FOLLOWING THE USE OF ANTIPNEUMOCOCCIC SERUM

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AFTER the use of antipneumococcic serum there is almost always a reaction—at times very profound. This reaction seems to have no relation to the curative properties of the serum. Good results are obtained in cases with both mild and severe reactions. Also, severe reactions occur in cases without remedial response.

The reaction is due to the introduction of the foreign proteid of the horse serum. The serum is not used, therefore, in cases with a history of asthma or where there is evidence of sensitization to horse serum.

To guard against sensitization, desensitizing doses of serum are always given before the first therapeutic dose. 0.5 cc. of the serum is injected either subcutaneously or intravenously; 30 minutes later 1 cc., 30 minutes later 2 cc., 30 minutes later 4 cc., the latter two times intravenously.

Only twice in our series of 200 cases have there been symptoms during the giving of the desensitizing doses. One patient had a slight nausea lasting for ten minutes after the 4 cc. dose. The other patient had an urticaria over a small area surrounding the site of the 2 cc. dose. In both cases the reaction following the therapeutic dose was very mild.

100 cc. of serum is the dose usually used. This is diluted with 100 to 150 cc. of normal salt solution, heated to slightly more than body temperature and injected slowly into the vein, the conducting tubes being warmed with hot-water bottles. It is the endeavor to inject the serum so slowly that half an hour will be consumed in the process.

The reaction that follows is never the same in any two patients, neither is it the same in the same patient when the serum is exhibited more than once. A patient having a severe reaction the first time may escape the reaction altogether on repeated doses, or may have a mild reaction or, again, one as severe as in the first instance. Some cases that have little or no reaction on the first dose will show most profound symptoms on the second. The interval of time between doses seems to have no bearing on the reaction with the second dose, although the longest period that has elapsed between doses is ninety-six hours.

The reactions following the use of antipneumococcus serum are so various that one can never be sure just what to expect. The reaction may begin as early as ten minutes after the serum of the final dose begins to enter the vein, or it may be delayed for some time after the

treatment is over. One case showed no symptoms for an hour and ten minutes, when a severe reaction of the urticarial type developed. Another case on the second dose of serum, forty-eight hours after the first dose, at which time there had been an immediate and very severe chill associated with weak heart action, had another reaction that did not begin for ten hours after the administration of the serum. The patient then was slightly chilly for over half an hour and subsequently broke into a profuse perspiration that lasted about six hours. The pulse was noticeably weakened during the whole of the perspiration, but the shock was at no time profound. A third patient having had no symptoms following his dose of serum for six hours, except a mild dyspnea, suddenly become faint and had a weak heart action for a short time. These cases, however, were the only ones in which the reaction was delayed, the space of a half an hour usually being sufficient to develop symptoms if they are going to occur.

While the symptoms are always various, each case being a law unto itself, the typical reaction may be divided into four stages occurring in rapid succession and a series of secondary symptoms occurring some days later. The first stage may be termed the stage of irritability, the second the stage of shock, the third the stage of hyperpyrexia and the fourth the stage of relaxation. Any of these stages may be very lightly stressed or even absent entirely. If any of the syndrome be absent it is more apt to be the symptoms of shock. The third stage is not always well marked, although some hyperpyrexia is practically always present. Because the reaction starts mildly or severely it does not follow that the subsequent stages are going to develop as initiated.

The first stage may pass quickly in five or ten minutes, or it may last more than half an hour; usually twenty minutes suffice. It may begin either as a flushing of the face, a burning of the eyes, an itching of the skin or an irritation of the bronchial tubes. Most frequently after the first symptoms, the face will become flushed, even when the flushing does not usher in the performance. This flushing often proceeds to a deep crimson. The pulse becomes accelerated, full and bounding, the veins on the forehead distend and there is a slight moistness of the skin. If the eyes are involved, as they may be even when their disturbance is not an initial symptom, they will itch and burn, often becoming bloodshot and quite swollen. A few patients have complained that the eye symptoms were so severe as to blind them for a time. An itching skin is a very constant symptom. It may be slight or very pronounced. It comes either as the first symptom or as a sequel to the flushed superficial capillaries. Often there are wheals developed on the surface of the skin, like an urticaria. These hives may be few in number or may cover

the whole body thickly. Occasionally they are no more than common "goose flesh," or they may be individually as much as 2 cm. wide and raised 2 to 3 mm. These wheals usually begin around the head and proceed down the body, fading off after a few moments in the same order. Those on the chest may not appear until after those on the face are gone, although the procession may be more synchronous and all be in evidence at the same time. When the bronchi are involved there is a peculiar dry explosive cough which sometimes comes in such paroxysms as to rack the patient's whole body. When this is one of the early symptoms, the sudden and spasmodic character of the movements causes danger of the needle, through which the serum is being given, being jerked from the vein.

Another bronchial involvement that may be associated with the first stage is dyspnea. The difficulty of breathing is usually mild and transient although in one case the dyspnea lasted for 24 hours, was very annoying, and was accompanied by a very definite asthmatic bronchial wheeze. The patient gave no history of asthma.

The itching skin, the burning eyes, the spasmodic cough, the difficult breathing, if any or all of them are present, naturally cause the patient to be very restless. This restlessness at times assumes a very marked character. The patient rolls in bed, tosses from side to side, and may even become delirious. The delirium usually confines itself to aberrancies of speech and is very transient in character. Some few patients attempt to escape. One man had a pronounced mania which lasted about an hour, beginning mildly and proceeding to such violence that it required five men to restrain him in bed.

The symptoms of the first stage, as above described, may be entirely absent and their place taken by a chill. When the symptoms of peripheral irritation are present a severe chill has never been noted, although the patient is often slightly chilly. On the other hand, when a marked chill supervenes it replaces all the other first stage symptoms, is usually very severe, lasting for as long as half an hour. This chill most frequently extends over the second stage, the symptoms of cardiac weakness being noted before the chill passes. As the chill leaves, the patient usually passes immediately into the third stage.

The first stage, as previously stated, presents a picture of an irritable, engorged, excited patient. It never occurs *in toto* as above described, one or the other groups of symptoms being emphasized or lacking, as the case may be. However, some one or more of the detailed symptoms usually marks this stage unmistakably. It has been noted that the different sera which have been used each has its predilection as to the type of first stage reaction. With one the urticaria is more often

present, with another the chill is the more frequent response, with a third the delirium is more common. However, any type of first stage may be present with any brand of serum used.

The first stage generally blends gradually into the second, although symptoms of shock may come with great suddenness. In cases where there has been little or no first stage and the patient has gone along normally for half an hour or more it is with a feeling of great surprise that the physician suddenly realizes that his patient is in the midst of a severe shock. Usually, however, the pulse loses its fullness, takes on a weak and thready character and may even become irregular—this possibly to such an extent that the pulse cannot be detected at the wrist. The flushed face gives way to a cyanosis, the bluish tint usually appearing first on the lobes of the ears. This is accompanied by a marked pallor which is in striking contrast with the previous flush. The patient begins to perspire freely, the cold sweat at times coming out over the body in great beads, so that the bed is drenched and a complete change demanded. The chill of the perspiration extends to the whole body, the extremities often being markedly cold to the touch. As the character of the pulse changes the patient becomes less restless, the delirium ceases, and he lies quietly, occasionally sinking into unconsciousness, from which he may be roused in mild cases, but which in rare instances becomes most profound. A well-developed case of serum shock is a most alarming spectacle. Though we have never observed a case in which the symptoms did not respond to treatment, it can easily be imagined that such an instance might occur if the case did not receive close attention.

Frequently after the second stage has become well developed there is formed a quantity of putrid gas. This is belched up or passed per rectum. The intestinal involvement may cause nausea, even to vomiting, or may bring on a profuse, exceedingly foul action of the bowels. If the patient vomits or has a bowel action it immediately terminates the stage of shock, the pulse picks up, and the faintness disappears. If the intestinal disturbance does not supervene, the shock passes gradually, the heart taking up more and more normal action.

The second stage does not always develop. When it comes it is often very transitory, passing of itself in 3 to 4 minutes. In its severe form, however, it may be half an hour before the patient responds to treatment. Adrenalin hypodermically, in severe cases intravenously, seems to be a specific for serum shock. It should be given freely upon the first signs of failing heart action and repeated as often as every five minutes until the patient shows signs of reaction. No serum should ever be given without having a supply of adrenalin on hand and a hypodermic syringe ready for use.

With the passing of the shock the patient gradually regains his tone and passes into the stage of hyperpyrexia. The pulse becomes full, the cyanosis disappears, and the face regains its slight flush. The cold drenching sweat is succeeded by a normal or slightly moist skin. The patient recovers from his collapse and is slightly restless. Within an hour or an hour and a half after the patient has received the treatment he usually has an elevation of temperature. This is the most constant symptom following the use of the serum, and it may be that the increase is due as much to the antitoxic properties as to the foreign proteid content of the serum. Although the rise in temperature is most constant it is not always pronounced and may easily be missed unless one be on the lookout for it. The ordinary elevation does not exceed a degree, though it is not uncommon to have the temperature go up to 106 or 106½ degrees. The stage of hyperpyrexia is often associated with a profuse perspiration; the break between the drenching cold sweat of the shock and the warm exudation of the fever can easily be overlooked. This stage is of varied length, often being over in half an hour, but at times lasting for an hour and rarely, longer.

Upon the recession of the temperature the patient enters upon the fourth stage and becomes relaxed. The pain is relieved, the restlessness passes, the temperature gradually falls, and the patient usually sinks into a peaceful sleep that lasts several hours. If awakened he will rouse, say that he is feeling more comfortable, and soon fall asleep again.

Six hours after the treatment, if the serum has accomplished its purpose and the toxemia of the pneumococcus is abated, the patient will have a normal, or much more nearly normal, temperature than before and, aside from the physical evidence in his lung, he often feels and appears perfectly well. Should the dose have been insufficient, or should the type of infection not correspond to the immunity conferred by the serum, the amelioration of the patient's symptoms will be little or none, even though the reaction through which he has gone has been severe.

The patient, when the reaction has been typically staged, has exhibited a surprising series of contrasts. First the flush, then the pallor and chill, succeeded by the extreme heat, and then the mild, peaceful sleep, in one who a short time before had presented the ordinary anxious, restless facies of pneumonia, give a moving picture in which the successive scenes are thrown on the screen with greater rapidity than is the custom with physiological reactions.

The day following the use of the serum there is an albuminuria which seems to be more marked than is the case with an ordinary pneumonia. However, since this symptom is so common in pneumonia

it would take a long series of closely studied cases to tell whether the serum has increased the incidence or the severity above the ordinary. While the albumin content may be high (44) it is not usually persistent, being cleared up in a few days' time.

From three to fourteen days after the administration of the serum, secondary symptoms may arise in the shape of an eruption, which is usually urticarial in nature, although it may be herpetic. It is, as a rule, transient in character, lasting only a few hours; however, it may continue for several days. The eruption appears anywhere, on the face, trunk, extremities, palms of the hands or genitals. It causes intense itching and, when it lasts more than a few hours, is exceedingly disagreeable. In some of the cases the urticaria passes over the body in a wave, lasting not more than two hours in all and not more than thirty minutes in any one spot. There are seldom concomitant symptoms, though a few cases have had a fever of 100 associated with the eruption which could be assigned to no other cause. One of these cases had a series of further symptoms that were most out of the ordinary. The man entered with an exceedingly weak intermittant pulse, one lobe only being involved. The administration of the desensitizing dose caused a slight nausea, but neither the first dose of serum, nor the second, next day, was followed by a marked reaction. The heart action improved steadily under digitalis and the pneumonia rapidly receded by lysis. Ten days later there developed a marked urtiearia that lasted for two days, the individual wheals being very large and permanent. During the second night the eruption suddenly left and a most intense hyperasthesia developed. The skin over the whole body was exceedingly sensitive, any touch, even of the bed clothes, being painful. Associated with this were marked arthritic symptoms. The joints of all the extremities were painful to even the slightest movement; there was a noticeable swelling of the hands which in one hand persisted for a day. Accompanying these symptoms there was a temperature that at its height was 100.5°, but which gradually fell during the day, being normal next day. The following morning the skin sensitiveness had departed; the joint symptoms were only faintly noticeable, except for the continued swelling of one hand. The urticaria, however, had reappeared in a mild form on the feet and legs. These wheals faded during the day, and ninety-six hours after the first symptoms of secondary reaction the syndrome had completed its cycle.

The antipneumococcic serum reaction is an exceedingly interesting set of symptoms which may undoubtedly be classed with that vast multitude of phenomena due to foreign and split proteid products, grouped under "anaphylaxis." When, however, the remedy is indicated, the possibility of reaction should not prohibit its use.

LESSONS DERIVED FROM THE TRAINING OF MEDICAL OFFICERS

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SHORTLY after the middle of October, 1917, a letter from the Surgeon General's Office was received by division surgeons. This letter outlined a course of intensive training for the medical officers, the enlisted men of the medical department and candidates for promotion to noncommissioned grades, in all the cantonments. I desire to discuss in a general way the methods used in the 79th Division in carrying out these instructions, and to draw some conclusions based on the practical working of the course.

The subjects to be taught were many and are known to all. It was found advantageous to consolidate certain subjects listed in the instructions under a common heading thus:

1. *Drill:* Infantry drill, sanitary drill, first aid, setting-up exercises.

2. *Manual for the Medical Department:* Geneva and Hague Conventions; cantonment, evacuation, base and general hospitals, including their organization, administration, records and management; contagious disease hospitals.

3. *Army Regulations:* Handling of rations, food, etc., and mess management; Manual for Courts-Martial; Articles of War.

4. *Field Service Regulations:* Rules of land warfare; sanitary service of line of communications.

5. *Military Surgery:* Liquid fire; trench foot.

This grouping of subjects eliminated extra instructors and was of advantage, as well, in permitting the instructors to allot their own time to the proper teaching of these subjects.

The schedule was originally arranged so that all the medical officers of the division would be taught simultaneously, that is to say, while an officers' drill was being conducted in the sanitary train, the same thing was taking place in the regimental classes. The medical officers of the division were divided at the beginning into four classes as follows:

Class I.—Medical officers of the 304th Sanitary Train.

Class II.—Medical officers of the 313th and 314th Infantry, 154th Depot Brigade, 311th, 312th, 310th Machine Gun Battalions.

Class III.—Medical officers of the 315th, 316th Infantry and 304th Engineers.

Class IV.—Medical officers of the 310th, 311th and 312th Field Artillery and 23d Engineers.

These classes were made up of organizations which were located so near together that they could easily gather for instruction at a given place.

Instructors in the various subjects were chosen from among the officers in each class, and were men who had had some knowledge of the subjects they were selected to teach, either from a medical officers' training camp or elsewhere. Of course, some of these instructors had to be relieved later because their reputed knowledge did not measure up to expectations, or because of lack of enthusiasm in the work, but, in the main, the instructors did very well, particularly in the sanitary train. A chief instructor was named in each class. It was his duty to appoint a place for drill and a place for the holding of lectures. He was also expected to keep careful check on the attendance of officers, and to exert a kind but firm supervision over the instructors in his particular class. The senior instructor in each class was required to submit a special report each week-end to the division surgeon showing in detail the subjects covered during the week and the number of hours devoted to each.

This system of dividing the officers into classes did not work out practically, in this division, for two main reasons: (1) The regimental sanitary personnel were promptly swamped by large numbers of physical examinations of drafted men. (2) Routine work assumed such great proportions, on account of the physical examinations and because of inexperienced assistants, that much of the schedule had to be abandoned for the time.

Most of the medical officers were doing their own clerical work and, at the same time, trying to break in green men as noncommissioned officers or clerks. While, as a general rule, they were men of ability in the handling of their organizations, they were not so well versed in the finer points of administration as to permit them to leave their routine work for a long enough period to attend the training course. The regimental personnel made conscientious efforts to carry out the schedule as laid down, but it was soon evident that some modification was necessary. Accordingly, the organization of classes was broken up, with the exception of the sanitary train, which continued as a single class to the end of the course. Each regimental detachment was constituted a class of its own, and each surgeon was designated to carry out the instruction. Instead of a hard and fast schedule, memoranda were sent out weekly, giving the subjects to be covered during that week and approximately the number of hours it was desired each unit should spend on each subject. Evening lectures for all the medical officers of the division were arranged to be held in the mess hall of one of the ambulance companies.

The sanitary train was able to carry out the schedule *in toto*, for the reason that the officers had no physical examinations to make, nor had they supervision of infirmaries and sanitation to the extent which prevailed in the regimental units. Furthermore, the sanitary train not being under the line, naturally had more leeway in the conduct of their organization.

A general check on the work of the different units was kept by a special officer designated in division orders as "Training Officer, Sanitary Personnel." This check was constantly exerted through frequent and unlooked-for inspections, roll-calls, and by written admonishments in the name of the division surgeon in flagrant cases of dereliction.

The lectures in the evening, at which all medical officers of the division were expected to be present, except one officer in each regiment to take care of emergencies, were especially interesting and were of an immense amount of benefit. Special mention should be made of the lectures on "Customs of the Service" and the "Medical Department in Campaign" by Lieut. Col. P. W. Huntington, Medical Corps; "Relationship of Officers and Enlisted Men" by Maj. Condon C. McCornack, Medical Corps; the "Tactical Use of Infantry" by Col. Otho B. Rosenbaum, 315th Infantry; "Sanitation in Cantonments with Special Reference to Camp Meade and with Demonstrations of Models" by Maj. Guy L. Qualls, Medical Corps. Lectures on genito-urinary diseases, military surgery and psychiatry were given by medical officers of reputation in those subjects. There was no trouble in securing qualified lecturers. It was exceptional for an officer to plead the pressure of duty in order to be relieved from the responsibility of lecturing. Everyone seemed glad to do some part, and no attempts were made to shift the burden to other shoulders.

In a course of this kind it is absolutely necessary that there be considerable didactic teaching. As much of the course as could be was coördinated with routine necessary work, and practical demonstrations were required so far as possible. An opportunity was, therefore, afforded for forming an opinion of the effectiveness of deductive and inductive methods of teaching. It was practically a unanimous conviction among the instructors that quizzes were of more benefit in instruction than lectures. While it was much easier for a man, well qualified in his subject, to lecture than to take the infinite patience to draw out the best points in a quiz, the men absorbed a great deal more information from the latter and remembered it better. This was particularly true where the material could be found in published books or pamphlets, and where the instructors had little to add. The taking of notes

during lectures, unless the notes be in shorthand, necessarily allows intervals or gaps in the theme which cannot be filled very easily. Subsequent quizzes reveal that many important matters are omitted from the notes. Consequently it is more than ever impressed on the writer that precious time is lost in lecturing and quizzing on the same subject. By quizzing, a good instructor can not only bring out points from his own experience, but can materially shorten the time to be devoted to a subject, as well as gain better attention.

Drill was given more weight during the course than any other subject, first, because drill is the best method of acquiring prompt obedience to orders (and everyone knows that medical men from civil life have usually been accustomed to doing things in their own time); second, drill properly taught gives the individual a military appearance, a set-up, which can only be acquired in that way; third, drill is the best teacher of coördination.

Infantry drill was used during the first couple of weeks because infantry drill is the real basis of our sanitary drill, and because a medical officer should be more or less informed about the parent of all drill regulations. Subsequently sanitary drill was instituted and maintained during the course. At first the officers were drilled in company together by an experienced officer. Later, as they became more proficient, each officer was given his chance to drill the rest. The importance of properly giving commands and of correcting mistakes was impressed on the officers as thoroughly as could be done.

Besides the practical drill, several quizzes were held in which medical officers were required to explain the movements laid down in the regulations as well as in the new litter drill as given in circular from the War Department. These quizzes were of immense advantage in fixing the knowledge gained on the drill field. Later, when the officers were sent to their respective organizations, they were in every way better qualified as leaders of men than they could have been in any other way.

Towards the end of the course a board of medical officers was appointed to conduct examinations in the course. These officers were instructed to take into account not only a man's proficiency in the course of training but his adaptability to the service, his initiative, his zeal, and his qualifications for purely professional work or work in the field with troops. The board framed a series of confidential questions to be answered by different superior officers concerning their juniors, and these reports were a vast assistance to the board in forming its opinion of the officers and in its findings.

A few deductions from the experience gained in carrying through this course of training may not be out of order:

First, a good organization is absolutely necessary. There must be a head and subdivisions, each with its own responsibility.

Second, a constant check must be exerted to prevent slackness, indifference, or lack of interest.

Third, classes containing more than one regimental medical personnel are only feasible when there are sufficient trained sergeants, and when the chaotic state preceding organization is obviated. Otherwise such a course must be left to individual surgeons.

Fourth, the Sanitary Train is perfectly able to carry out a schedule in detail as a unit.

Fifth, deductive teaching is the better method for rapidly impressing essential matters. Inductive methods seem to waste much valuable time.

Sixth, drill is properly taught practically both in and out of ranks, and this practical instruction should be supplemented by quizzes to fix the knowledge gained.

Seventh, an examination by a board of medical officers is indispensable, because it serves to stimulate the acquisition of knowledge and attention to duty. It is likewise a good filter by means of which medical officers of known inefficiency can be found wanting, officially.

EDITORIAL

PUNISHMENT OF ARMY MEDICAL OFFICERS

The dismissal from the service, by sentence of court-martial, of two medical officers of the National Army and the return of the proceedings to the court by higher authority, calling attention to the inadequacy of the punishment, may well give us pause.

We are not permitted to, nor would we, question the findings; no doubt these presumably young, and certainly inexperienced, medical officers were guilty of conduct prejudicial to extreme humanitarian practices, though, we are told, one was strictly obeying an order and the other a regulation. They were not soft and sympathetic, but were they guilty of conduct to the prejudice of military discipline, or unbecoming an officer and gentleman?

It cannot be accepted that the medical officer has no responsibility for the discipline of the army; every officer has that. To be sure, he has nothing to do with "knock-down and drag-out" methods, but he has a moral function which, if properly exercised, should be a real factor in military discipline. To meet this obligation demands a tact and experience which we do not expect to find among the very recently appointed medical officers and, for these reasons, either they should not be placed in positions of responsibility or, if necessity requires that they must, their limitations should be given due weight.

We learn from the public press that in one of these cases it is alleged a soldier suffering from pneumonia in advanced stage reported at surgeon's call for treatment and, because of failure to properly salute the attending medical officer, was reprimanded, given "double duty" (which he did not perform), and died two days later.

In the old Army, at least, it was not customary for the soldier to salute when reporting to the surgeon at surgeon's call. He removed his hat and awaited interrogation; he was treated with consideration and the medical officer with respect. Of course, all who know anything of military matters understand that the procedure at this function is eliminative—the separating of those who are, in the opinion of the attending surgeon, incapable of performing their military duties from those who are capable. The men whom he deems incapable he recommends to be excused in quarters or hospital, and those who are, in his opinion, capable he recommends to be returned to duty. He is absolutely without power of execution; his sole

function is that of recommendation. To be sure, the commanding officer usually accepts the recommendation of the surgeon, but he is not obliged to; nor did he in this case—at least, the company commander did not.

Ordinarily, the surgeon does not place a man's name on the sick list; that is done by his company officer and, according to the phraseology of army regulations, "the enlisted men of each company who require medical attention will be conducted to the hospital or infirmary by a noncommissioned officer, who will give to the attending medical officer the company sick report book containing the names of the sick. The medical officer, after examination, will indicate in the book opposite their names the men who are to be admitted to hospital and those to be returned to quarters, noting what duties the latter can perform and any other information in regard to the sick which he may have to communicate to the company commander." From this it will be seen that "surgeon's call" is a formal function and should be conducted in a military way.

It would appear from the published reports that this regulation was carried out and the attending surgeon must have examined the man, for he noted that, in his opinion, the soldier was capable of performing full duty, indeed "double duty," though just what this means is not apparent. He probably was mistaken, as the man died two days later of pneumonia.

We have not read the evidence, but he might not have been mistaken in his diagnosis. The case of a well-beloved general officer, who recently died of pneumonia, comes to mind. One Sunday he arose feeling unusually well and spent the day automobiling. That night he was taken with a chill and died the next day of pneumonia.

Now, let us consider the situation generally. Our camps contain a certain number of unwilling soldiers who seek any possible means of getting out of the service short of desertion, and some do not stop at that. The admirable article on "Malingering" appearing in this number of THE MILITARY SURGEON, by permission of the Surgeon General of the Army, gives very convincing evidence that the "slacker" is amongst us and that his assault is chiefly upon the Medical Department. This being the case, is it surprising that our inexperienced medical officers should lose patience and poise in their sometimes ill-judged efforts against malingering? In this case, unfortunately, the wrong man was picked. But, says the humanitarian, is it not better that ninety-nine malingerers should

escape than that one sick man should be punished? Possibly, but what would be the result of such on the efficiency of the Army? Soldiers are not humanitarians and war is not soft. To win it is the sole object of our existence as soldiers and the only measure of our efficiency.

A medical officer has been dismissed from the service because of a mistake in diagnosis, which led him to mark a man for duty in what he probably thought was the interest of the service. There may have been attending regrettable circumstances and he may have been unfit, generally, for his important office. We don't know, but these are the underlying facts. Is it to be presumed, in the light of these facts, that any wise medical officer who desires to retain his office and avoid the possibility of imprisonment—for this is apparently what the authorities wish to inflict upon this officer—would ever again send any man to duty who reports at surgeon's call and insists that he is sick, if the authorities should persist in such an attitude? From the time medical officers are convinced that this is the unalterable determination of the War Department, the sick report will go up with leaps and bounds, the medical officers will cease to perform their highest function, "the maintenance of strength of armies in the field through the prevention of disease," and the Army will become a mass of malingering "invalids," demanding all their time and attention.

The persistent and unwarranted attacks upon our medical officers in 1898 resulted in just this condition. The sick rate went up stupendously and continued for years after that war, during which period Sir Alfred Keogh remarked, "The American Army has the worst sick rate of any army in the world." This was the direct result of dread on the part of our medical officers that they might be treated as this physician has been.

If medical officers are guilty of a military crime, they should be punished like other military officers, but if they are to be declared felons because of a mistake in diagnosis, who of us can escape? We are trained in the school of humility and self-sacrifice; we have renounced much of our material interests to loyalty to our country and the desire to be of assistance in this great emergency; we are even willing to be a camouflage for the shortcomings of others, but we insist upon reasonable freedom of opinion in the practice of our profession, with a fair margin for error, and equal justice with other officers in the exercise of our military duty. If we steal, we should go to the penitentiary, but not if we are mistaken in the

diagnosis of a case. If we cannot have this freedom and justice; if we cannot be exempted from the daily interference of line inspectors wholly unfamiliar with the conduct of hospitals of any kind, but who, apparently, are authorized to give orders concerning such, notwithstanding that the Medical Department has trained inspectors for this very purpose, we must fail in our work.

THE MEDICAL CORPS OF THE ARMY

Almost a year has elapsed since war was declared, and it is well on toward two years since mobilization on the border was ordered, so quite time enough has been afforded to determine whether or not the Army is developing a real medical team.

We certainly started off better than ever, for from the beginning we had, what our country never before had, a fairly clear-cut idea of what there would be to do and how to do it. We had determined upon the form of our matériel and had collected as much of it as Congress would permit; we had set forth in our regulations, so clearly, the official duties of the Medical Department and how to accomplish them, that even "those who run might read" and understand them; and, better than all, we had had not only most of our Regular medical officers on the border for months, but many of those of the Reserve and National Guard as well, trying out our plans; so we started into the war with a greater number of fairly well-trained medical officers than at any time in our history. Nor was this all, for the department had endeavored, in every practical way, to disseminate among the profession at large a working knowledge of the Medical Department.

All of this effort, beginning with the Spanish War, has enabled us to make an unprecedented start and already to reach, with us, unprecedented results. Probably no people ever mobilized from a condition of profound peace, from a state of mind to which war was utterly abhorrent and who were so wholly unprepared for military activity, with such relative smoothness as did ours. In this the Medical Department had, did, and is doing, its full share. Nothing but praise is due us, in the aggregate.

Now comes the question: Is there room for improvement? If so, where and how? Owing to antecedent conditions, a compromise between the best and the possible, we started into the war with an organization which was not homogeneous; we had, and continue to have, officers coming from at least three distinct classifications, each one of which is irresistibly actuated by impulses quite different from the others. The law itself makes certain distinctions in status, and regulations attempt

to make others, which the Judge-Advocate General is frequently called upon to interpret, so involved are things. Such a condition must of necessity interfere with the solidarity of the corps and seriously hinder the all-round team-play so necessary to continuing good results.

Now that we are getting to have a reasonably fair understanding of our duties, would it not be better that we should all belong to the Medical Corps, U. S. Army, without any hyphen? Regular, Reserve, Militia have today no real significance, so far as duty status is concerned, and why should they remain to differentiate us, when differentiation is unnecessary, indeed actually harmful?

In the permanent establishment the law recognizes two classes of active officers, "permanent" and "temporary," the status of each of which is known to all, both having equal standing as to rank and promotion. What better precedent than this do we of the Medical Department need? Put us all into the Medical Corps U. S. Army, the M. C. P. and M. C. T. being exactly upon the same status in every respect, except as to tenure of office. Then, when the war is over and the necessity for an enlarged permanent corps arises, which has always been the case, those who elect to remain and whose record and proved attainment justify, can change the T to the P, without any other change.

The following amendment to the National Defense Act (S. 1786), introduced by Senator Owen, is now under consideration and undoubtedly will pass in some form—

Provided, That hereafter the commissioned officers of the Medical Corps of the Regular Army shall be distributed in the several grades as follow :

		Per cent
Major generals		0.25
Brigadier generals		0.25
Colonels		4.00
Lieutenant colonels		8.00
Majors	23.5	
Captains	32.0	
Lieutenants	32.0	
		87.50
		100.00

Provided, That when called into service the numbers of the officers of the Medical Reserve Corps shall be seven to the thousand of men in the National Guard and National Army and the relative grades of the officers of the Medical Reserve Corps shall be the same as the grades of the Regular Army.

The President shall have authority to appoint officers of either corps as "consultants," with the duty of acting in an advisory capacity, making inspec-

tions and reports on medical, surgical, or sanitary questions, and such other duties as may be required by the chief of the Medical Department.

Should the second proviso be changed by a few words we would have a homogeneous organization, every member of which would stand four square with every other, the name of every officer would have a fixed place on the single roster of the Medical Corps, relative to every other officer, and M. R. C. and N. G. would be relegated to obsolescence in the active army. A seemingly little thing, but an immense promoter of efficiency both in administration and execution.

To accomplish this, the second paragraph should be changed somewhat as follows:

Provided, That when the officers of the Medical Reserve Corps and of the Medical Corps of the National Guard are called into service, they shall become temporary officers of the Medical Corps, U. S. Army, and shall be in number equal to seven to the thousand of men in the National Guard and National Army, and the relative grades and rank of the temporary medical officers shall be the same as that of the permanent officers of the Medical Corps, U. S. Army.

With such a law and our organization completed, we would have a corps the *esprit* and efficiency of which would be unsurpassable.

THE HIGH HEART

More and the more the deeper significance of the struggle in which our Allies have been engaged for over three years, and in which we are now to join them, comes home to us who associate daily with the brave men who come back for a few days from hell, to return again with strong and steadfast confidence in the ultimate outcome. How can they endure it? How can they keep on without a thought of yielding?

There is only one possible solution to this psychological problem. It is not solely a question of military discipline, of mere physical endurance. "It is the Spirit that quickeneth," as Sir Douglas Haig has always held, and who is more competent to judge? "Moral" we call it in formal definition, but it is deeper than that, for only great souls can inspire such deeds.

Much has been written about the superb courage and *élan* of the French and British soldier, but words are imperfect media through which to picture them. Only one thought is uppermost as one, who has never been under fire, hears from their own lips how these brave men calmly and without fear go forward cheerfully to certain fate, led by their officers whom they trust in life and death. Yet these men are peaceful and home-loving, like our own citizen-soldiers, and do not kill for mere lust of slaughter. Those who escape, shattered and broken for life in their glorious young manhood, have no regrets that they are

flung out of the battle, driftwood on the fiery waves. It was their duty and they ask no more. Wounds, agony, death—all are mere episodes, and the individual is content to be only an atom in the large design. This is what keeps them to their hard and apparently hopeless task, and this will keep them to the end.

One is silent before this. "It is high, I cannot attain to it."

We have reason to be proud of our medical reserve corps. I have talked recently with a little group of young lieutenants ill in hospital, suddenly transported from a peaceful, humdrum country practice to all the horrors of Flanders. They are all alike—they have caught the inspiration of their British comrades and have been cast in the same heroic mould. They will all return there, for they cannot do otherwise. No thought of promotion, no care for medals and decorations—only duty. Ye gods! When I think of the mushroom captains and majors at home, of the carpet-knights who are counting the cost, I wish that they could hear the experience of these boys.

Physical training and military discipline, sanitation, paper-work—they are all right in their place, but they will be merged, in the trench and dugout, in No Man's Land, in the cold and wet and hunger, into the spirit, which alone remains.

Shall we not teach that, shall we not analyze and eliminate the causes of fear, shall we not cultivate in our young medical officers strong hearts and calm minds in every emergency, failing which all theory and practice are vain?

One's viewpoint changes over here. We wonder if we shall stand the test of battle as well as the medical officers of our allies have done and be ready, like them, for the supreme sacrifice. We *must*. There can be no swerving from the path that lies before us, stretching far into the unknown future and ending God knows where. The high traditions of our corps must never be forgotten. Only the high heart can keep us strong and true to the end.

H. C. Coe.

ASSOCIATION NOTES

A meeting of the Executive Council, at the call of the president, was held in Washington, February 12, 1918, to provide for the temporary filling of the office of treasurer, Assistant Surgeon General William C. Rucker, U. S. P. H. S., having been ordered to duty in foreign parts.

Col. John Van R. Hoff, M. C., U. S. A., Retired, a former president of the Association, consenting to act temporarily, was duly elected treasurer *ad interim*. He requests that all correspondence with the treasurer's office be addressed to *The Association of Military Surgeons U. S., Army Medical Museum, Washington, D. C.*

The following named 189 gentlemen, having qualified, were duly elected members of the Association:

Medical Corps, U. S. Army

Major

Frank K. Boland
Henry K. Gaskill
James F. Johnston
James S. McLester
Eugene E. Murphy

Captain

Geo. W. Jean, Ret.

First Lieutenants

Wm. Milton Caffee
Gilbert O. Crank
Wm. D. Middleton

U. S. Navy

P. A. Surgeon

Clarence C. Kress

Assistant Surgeon (R.F.)

Ralph A. Gowdy,
Harrison L. Wyatt

Associate Member

Benj. H. Frayser, formerly 1st Lt. M. R. C., U. S. Army

Medical Corps, National Guard (U. S.)

Majors

Floyd J. Bolend
Victor E. Bonelli
James H. Gambrell
Robert A. HassKarl
Thos. J. McCamant
John J. O'Reilly
Claude L. Pridgen
Thomas H. Scott
Ross H. Skillern
Homer T. Wilson

Captain

Carlos G. Webster

First Lieutenants

Charles P. Austin
Carleton B. Austin
Fager M. Babcock
Jacob O. Carpenter
James H. Damron
William P. Fite
Stephen H. Graham
Julius A. Johnson
Robert S. McGeachy
Ben M. Meriwether
Solon Miltner
Paul C. Murphey

1st Lieutenants–Con't.

John Z. Niraz
Claude V. Orr
David B. Sloan
Fred W. Standefer
Andrew M. Young

Medical Reserve Corps, U. S. Army

Major

E. L. Parmenter

Captains

William H. Baldwin
Benj. Clyde Barnard
Edgar W. Bedford
Ernest H. Bitner
John Bryant
Michael A. Burns
G. Edward Campbell
William G. Cassells
Geo. P. Cogswell
Clarendon J. Combs
Omar L. Cox
Charles P. Edwards
Eugene C. Foote
John M. Firmin
Chas. B. Fitzpatrick
Roy H. Garm
Ejnar Hansen
Joseph C. Hynes
Charles S. Jordan

Captains–Con't.

Judd H. Kirkham
Otto W. Koch
C. S. Lawrence
Mason B. Light
Virgil Loeb
Cabot Lull
William G. Maness
Smith E. McAdoo
Thomas R. McHugh
Leon S. Medalia
Harry T. Morton
Wm. S. Newcomet
Samuel D. Nixon
Gilbert R. Owen
Henry Pleasants, Jr.
Daniel P. Ray
Henry O. Reik
Herman H. Runo
Millard F. Sewall
Edward Swann
Austin L. Ward

First Lieutenants

Earl V. Adams
John L. Aleshire
Andrew J. Andersen
John H. Arnett
George A. Baker
Edw. F. W. Bartol
Harry F. Beebe

1st Lieutenants–Con't.	*1st Lieutenants–Con't.*	*1st Lieutenants–Con't.*	*1st Lieutenants–Con't.*
Edward P. Berg	Louis E. Eslick	James M. Kerns	Donald W. Porter
Alex. S. Blanchard	William J. Ezickson	Lucius Lamar	John G. Pratt
Joseph A. Boarts	William J. Ferguson	Herb. S. Langsdorf	Carl H. Robinsteen
Julius R. Bolles	Eugene E. Fleming	Joseph S. Lawrence	Floyd P. Romberger
Ralph H. Bookmyer	R. R. T. Furlong	Milford Levy	John T. Rose
Leonard J. Bowman	Robert L. Gallaher	Robert L. Levy	Alvin P. Scheib
Lewis L. Brodsky	Lucius G. Gage	Moses Lobsenz	Sidney Scheinman
Wm. E. Broughton	William H. Gehl	John P. Long	Nathan S. Schiff
Albert J. Bruecken	Charles W. Gentry	Michael R. Long	Henry H. Sherk
John F. Byrne	Francis M. Ginley	Dennis J. Lowney	Percy B. Skinner
Robert E. Calhoun	James M. Graham	Thomas W. Martin	Elisha B. Smith
William J. Circe	Benj. E. Graham	Selim W. McArthur	Austin E. StClair
Edward P. Clark	William S. Gramling	William C. McCord	Henry W. Straus
William P. Clough	Thomas W. Grayson	Harold J. McDonald	David Sussler
Chas. W. Colebaugh	P. Guitierrez	Clar. R. McDonald	Dolph M. Teixler
J. de Raismes Combes	Claude F. Hayes	Joseph O. McKeon	Langdon T. Thaxter
Hugh I. Conn	Eugene H. Hayward	Monroe A. Meyer	George H. Trevelyan
Grover C. Conyers	Ara B. Hewes	Walter L. Misener	Thaddeus S. Troy
James P. Crawford	Simeon Hopper	D. DeW. Monerief	Cyrus W. Truxal
Royal C. Danley	William R. Johnson	Levi Murray	Louis J. Ullian
Willis L. Dixon	Charles L. Jones	Arthur S. Needles	Fred S. Watson
William Dwyer	Ester L. Jones	Harold R. Necland	Frederic B. West
Burt A. Dyar	Lawrence J. Kaasa	Carl A. Neves	Cloyd F. Wharton
Franklin C. Eleded	Clifford L. Kaucher	James L. Orr	Roderick B. Wittich
Edgar B. Elvis	Claude D. Kellam	Hamilton C. Perkins	Sid. J. Wolfermann

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The Royal Society of Medicine Club, London

The Royal Society of Medicine, London, has extended to all our medical officers the privileges of its famous Club House, during their sojourn in London. In a recent letter the general secretary wrote: "I hope you will do all you can to make as widely known as possible our invitation to our American friends, for, although I have done everything I can, I still meet many of your officers who know nothing of it. I wish it were possible for your Army Medical Service Department to take official cognisance of it and inform all its officers before they set out for this side. If this could be done I would gladly send over a supply of circulars for this purpose."

COMMENT AND CRITICISM

METHOD OF PROCEDURE IN THE EXAMINATION OF SELECTED DRAFT AT CAMP UPTON, L. I.

THE MILITARY SURGEON is glad of the opportunity to publish Lieut. Col. Charles R. Reynolds' report of the physical examination of the men of the command of which he is the division surgeon. This report sets forth clearly and briefly a very practical, efficient and quick way of performing what is a most important, not to say stupendous task. It also presents certain recommendations, which evidence the fact that the last word has not yet been said regarding these examinations of great masses, and suggests the thought that THE MILITARY SURGEON would be pleased to hear from other medical officers who have directed or participated in such examinations, upon this subject—EDITOR.

1. *Arrival of Troops.*—Troops arrive at camp the day before the examination is to take place and are housed in casual barracks; sometimes being definitely assigned to organizations at this time or immediately after physical examination. After passing through officers detailed from the mustering office and receiving their qualification, designation and assignment, and physical examination blanks, Form 1010 P. M. G. O., they are ready for the physical examination.

2. *Preparation for the Examination.*—The same evening complete alphabetical lists of all men arriving at camp, according to the barracks in which they are located, are forwarded to the officer in charge of physical examinations. Accompanying these lists are forms 1010 P. M. G. O.

These lists are all checked to see that the examination blanks tally with the names on the list. The lists show the local board number, serial number and call number of each man, and are valuable as means of identification. All men whose records are not complete are held in the casual barracks and are not examined until all records pertaining to them have been received. The mustering office is charged with the correspondence necessary to obtain the record.

3. *Method of Examination.*—The arrival of the men at the examination room is regulated by directions from the medical officer in charge, who calls for detachments of 200 men, under their barrack or company commanders, who await examination of their men.

Two hundred men an hour is about the rate at which they are called, thus making it possible to examine, with the scheme hereafter outlined, about 1,600 or 1,700 men per day.

One of the infantry barracks is obtained for doing this work. It is divided into four large rooms and arranged so that each complete examining team occupies one room, as per diagram page 341: Each examining team is composed of eleven medical officers, one dental officer, and forty enlisted men. Each man has his own particular work to perform. The examination room is so arranged that a steady, straight line of recruits passes from one examiner to the

other without turning back until each examination is completed. This avoids confusion and prevents men getting away without complete examination. The arrangement of the examiners is as follows:

At the table for giving out the recruit cards, Form 80, and the identification blanks, are seated five enlisted men who record the name, address, local board number, serial number, and fill in certain data on the identification blanks. From there they pass to the dental surgeon, who has one enlisted man as assistant and recorder. From there they go to the

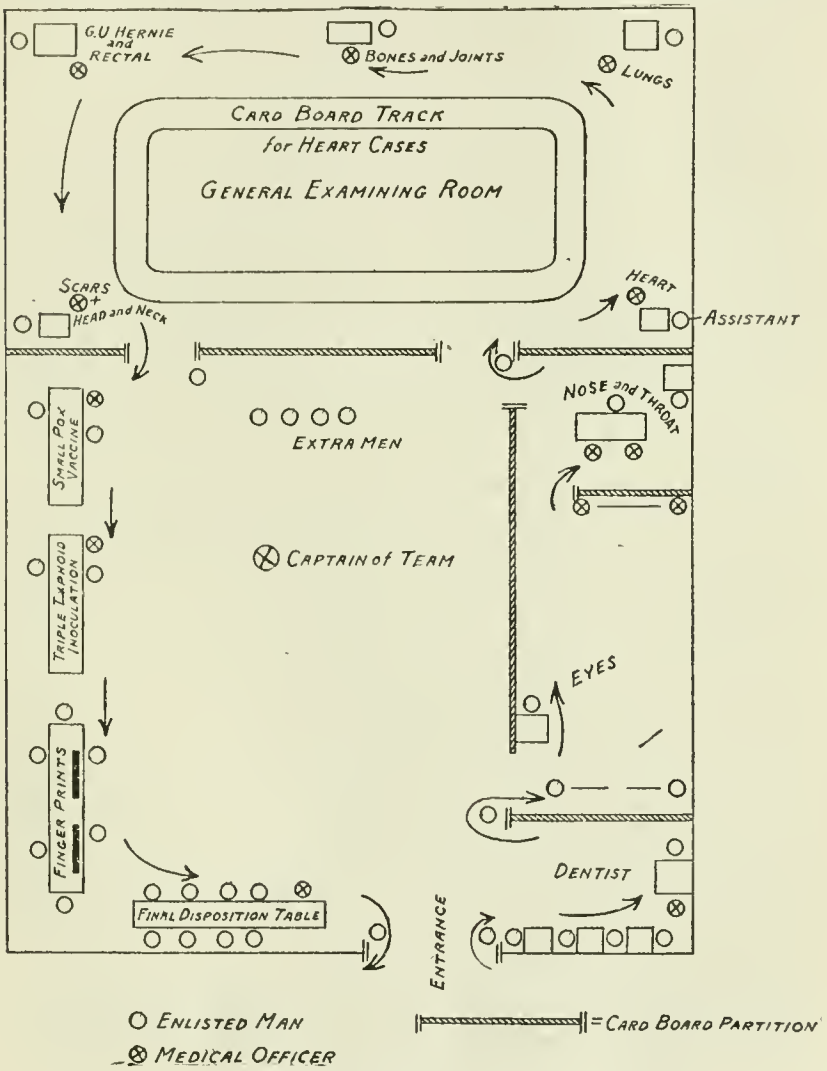


DIAGRAM OF EXAMINING ROOM OF EACH TEAM

eye room, which is in charge of one medical officer and four enlisted men; then to the ear, nose and throat room, which is in charge of one medical officer and two enlisted men. From there they go to the general examination room, where the examination is conducted in order—bones and joints, in charge of one medical officer and one assistant; from there to a medical officer and one assistant who examine the heart; then to a medical officer with one assistant who examine the lungs; then the height, weight and chest measurements, four enlisted men and one acting as recorder, and from there to genito-urinary, hernia and hemorrhoids, in charge of one medical officer and one assistant. From there they go to a medical officer, who has one assistant, who makes a superficial examination of the body and completes the outline figure card. From the general examining room they pass to another screened-off section, where one medical officer and two assistants give the smallpox vaccination, immediately followed by the triple typhoid inoculation, under the direction of another medical officer and two assistants. At this place the Schick test can be administered unless it is advisable, as has been found to be the case at this camp, to start the Schick test at the time of the second typhoid inoculation. Too many inoculations and vaccinations sometimes will cause a large proportion of the men to faint. From here the men go to the finger-print table, which three enlisted men operate under the supervision of a medical officer. At this point, unless the men are especially skilled, there is liable to be delay necessitating doubling the number of men at this table, which we found to be necessary in most instances at this camp; that is, six finger-print operators for each team, or eighteen altogether in the building. The number is entirely dependent upon the necessary speed to be maintained.

The men now pass the final table, at which are seated eight enlisted men and one medical officer. Their duties are to transcribe the physical findings from the recruit card to the physical examination blank, Form 1010 P.M.G.O., to see that all data are correct and that the man goes through with the papers in his possession. The medical officer signs both the physical examination and identification forms. If the medical officer at this table directs a special examination, as shown by the recruit card, the man is sent to the special examining room, to the particular specialist which his condition requires. It is necessary at this point to have an orderly conduct the man to the special board. From the special examining room the recruit is conducted into the office of the "officer in charge," who rules upon the data sent in by the specialist and recommends, according to the requirements of the War Department, whether or not the man is accepted for the military service, and signs the examination blank accordingly.

One team of examining specialists has heretofore been sufficient to handle the number of examinations turned out by three examining teams—about 20 per cent of the total number examined.

No man is recommended for rejection or discharge until he has been through the special examining board.

Acceptance.—All men accepted are sent in command of their organization commanders to the Mustering office immediately after examination. Each man carries with him Form 1010, P. M. G. O., identification record and designation card.

Rejection.—Complete tabulated lists are prepared in the case of all rejected men, giving the name, local board number, home address and cause for rejection. Two of these are sent to the mustering officer with the men, usually in groups of about twenty, with all their papers for immediate discharge. They are discharged by the mustering officer on Form 638, P. M. G. O., by authority delegated by the division commander. One copy of this list of men recommended for rejection is immediately sent to division headquarters for the preparation of an order directing the discharge. This is necessary, as the men may have been assigned to organizations, and from the list the company commander can obtain all the data necessary for his muster roll, pay roll and other reports.

Two copies of the list of rejections are retained at the examination barracks. This is important for future reference, as experience has shown the necessity of referring to a large percentage of these cards at later dates. The cards, Form 80, of accepted cases are filed alphabetically and also according to date of examination. The cards of those recommended for rejection are filed in a similar manner but separate from those accepted. Each month a complete alphabetical tabulated list of all rejections is made and kept on file in the office of the division surgeon for reference, which has proven a necessity..

In this scheme it will be seen that there are six examining teams in addition to one team of specialists; three teams work four hours in the morning and three work four hours in the afternoon, arranged by roster. The captain of each team is held responsible for the presence of officers and enlisted men and for errors incurred in the examination of recruits and the papers connected therewith.

Special Board Composition.—One dental surgeon, three eye specialists, two ear, nose and throat specialists, two specialists in tuberculosis or lung diseases, two cardio-vascular specialists, one surgeon, one orthopedist, and two psychiatrists or neurologists.

Recommendations.—Assuming that a new body of men is to arrive in daily increments, to replace a departed division at a cantonment complete in point of construction, and with at least a large part of the divisional medical personnel for the new division, it is recommended: (1) That the routine physical examinations be conducted by the divisional medical personnel, arranged in concentrated teams or boards, as outlined in the description of the method of examinations of the Seventy-seventh Division at Camp Upton—September to December, 1917. (2) That special boards, composed of one dental officer, three eye specialists, two ear, nose and throat specialists, two specialists in tuberculosis and lung diseases, two cardio-vascular examiners, one surgeon, one orthopedist and two psychiatrists or neurologists, be provided for each camp, to pass on all abnormal cases before they are recommended for rejection. These boards might be assembled from the personnel on duty at the base hospital, or organized and go from camp to camp, as required.

In favor of this scheme of examination as against the method of examination by the regimental surgeons of their own men after assignment, the following advantages are suggested: (*a*) A high degree of effectiveness and team work is obtained, and large numbers of men can be examined in a short time. It is

COMPLETE STATISTICAL REPORT OF EXAMINATION OF RECRUITS AT CAMP UPTON, LONG ISLAND, NEW YORK, TO DECEMBER 20, 1917.

	1, 2, 3 and 4 increments	5th increment (colored)	6th increment	Men arriving during interim[1]	Total to above date
No. of men examined	29,947	1,200	8,365	2,188	41,700
No. of men rejected	2,239	79	633	879[2]	3,830
No. of special examinations	4,200	200	1,963	2,560[3]	8,924
No. of hours per day worked	8	8	8	Avg. 8	Avg. 8
No. of doctors on each examining team	11	11	11	" 11	" 11
No. of teams working at one time	3	3	3	" 1	" 3
No. of doctors on special team	12	12	12	" 12	" 12
No. of hours worked by each team daily	4	4	4	" 2	" 4
No. of teams working daily	6	6	6	" 1	" 6
No. of enlisted men on each team	40	40	40	" 30	" 40
No. of hours worked by special team daily,	8	8	8	" 2	" 8
Total No. of doctors employed	78	78	78	" 24	" 78
Total No. of enlisted men employed	280	280	280	" 60	" 280
No. of days required to complete examination,	14	1	5	.....	" 55
Total No. of hours worked by teams	112	6	30	" 120	" 277
No. of men examined per hour	267	200	214	" 140	" 205
Percentage of rejections	7.47	6.5	7.5	.....	9.2
Time necessary for one man to be examined, in minutes	30	40	34	.....	30

[1] In the column headed "Men arriving during interim" it was very difficult to keep an exact tally on the work performed by each team, as this work was done more leisurely and the casuals came in a very irregular manner.
[2] Includes rejections upon reëxamination.
[3] Includes special examinations made on men who were reëxamined.

the only method that will be satisfactory in a rush. At this camp we examined over 2,800 men in a day in some instances. (*b*) All doubtful cases can be referred immediately to the specialists and prompt rejections made. (*c*) All records are concentrated in a central recruiting office, which experience shows, continues to function thereafter in furnishing information and data for future examinations and reëxaminations and for the many inquiries, requests and complaints that are received. (*d*) It offers opportunity for supervision impractical with regimental teams. Only one experienced supervising examiner is required to pass on all cases recommended for rejection or presented for decision. (*e*) It offers good opportunity for conference and consultation and instruction of all routine examiners by the specialists. (*f*) It is a necessity and works well in case men are not assigned to regiments immediately upon arrival. There will always be casuals or unassigned men, and a concentrated casual medical personnel must be provided for these. It is extremely important where a camp is not completely constructed and in which the tactical organizations have not been organized or formed.

3. *Oversight of Local Examining Boards by Experienced Medical Officers.*—The greatest number of mistakes made by the local boards are in the acceptance of cases of defective vision—over 30 per cent of all rejections at this camp. It seems likely that the local boards are suspicious of defective vision cases and send them to camp in order to play safe, or possibly because they are not equipped with the proper facilities for making examinations. It is understood that a supervisory or consultation board has been arranged, but if not, special boards might be appointed to visit the large recruiting centers to pass upon doubtful cases before they are sent to camp.

4. Complete cardio-vascular examinations should be made at the time of original physical examinations.

5. The tuberculosis survey should start immediately so as to complete all examinations within one month after the men report for military service. The earlier rejections are made, the fewer cases of claim on the Government will be presented. War risk insurance and allotments should not be allowed until all of these examinations have been completed.

6. Rejections upon reëxamination are authorized to be made on Form 638, P. M. G. O.; this without the preparation of certificates of disability. Discharges or rejections upon reëxamination should be allowed only in cases referred to and passed upon by the Special Examining Board.

7. Abolition of the sick and wounded cards, Form 52 (of rejected men at first examination at camp). It is believed that Form 1010, P.M.G.O., should be accepted as the substitute for sick and wounded cards as it contains all essential data. Difficulties of magnitude are encountered in the preparation of the sick and wounded card and numerical sheets, in camps, before the complete organization of regiments and regimental infirmaries and with inexperienced medical officers—conditions very likely to exist in the future.

8. Abolition of finger-prints (identification record). This is presented for consideration, but definite conclusions have not been reached at this camp. After weeks of training, identification records are satisfactory; before that most

were almost useless. Special training of enlisted personnel must be given before the examination of increments begins, otherwise nothing but failure will result in the hurried examination of large bodies of men. The value of finger-prints to the War Department must be decided there; so far, at this camp, the use of them for subsequent identification has been invoked in but one case. In this connection we invite attention to the necessity of recording and filing the identification records of all rejected men as, under the selective draft law, these would seem to be of importance in investigating cases of impersonation.

TO ELIMINATE LICE[1]

Major D. R. Lucas, M. R. C., who several years ago devised and described in THE MILITARY SURGEON a "straddle trench cover," with opportunity and experience has developed this into the "squat latrine cover," the advantages of which he has set forth in an official communication we shall presently quote *in extenso.*

Lieut. Col. John W. C. Abbott, C. A. C., commanding Fort Tilden, where Major Lucas was on duty, forwarded the latter's report with the following indorsement. "The latrine cover is the most satisfactory and sanitary, the simplest and cheapest to construct and the easiest to transport, of all the devices for this purpose that have been brought to the attention of the fort commander."

THE MILITARY SURGEON has heretofore quite emphatically expressed its views as to the many advantages of the squatting over the sitting position, in the act of defecation, and it lives in the hope that the time is not far distant when the so-called box latrines shall be wholly abolished in our service except for the aged and invalid. Even in barracks the "squat cover" placed over a trough of running water would be equally acceptable and far more sanitary than the present public toilet, which everybody approaches with suspicion—while the physiological advantages of the posture cannot be questioned by anyone who is at all familiar with the instinctive habits of mankind. We wonder if such an appliance is shown and discussed in our schools of applied hygiene.—EDITOR.

Major Lucas writes as follows:

Lice are now recognized to be a factor of such magnitude in decreasing the effectiveness of troops engaged in this war, as to call for every possible means looking to their eradication. It has recently been determined that lice are the chief agent in transmitting typhus fever. Their effect in this respect has become so prominent that their action in producing ill-health and loss of effectiveness of troops in other ways, (through itching caused by the insertion of the haustellum, and the dermatitis, of eczematous character, from scratching, not to mention other fevers), may be underestimated. The latter effects should not be neglected or minimized. Typhus fever will, we believe, be as effectively prevented by prophylaxis as has typhoid; but this confidence may

[1] With three illustrations.

lead us to neglect an important cause of noneffectiveness of troops through irritations of the skin. We mean *Pediculi hominis.*

There are three varieties of lice that infest the human species; namely, the *Pediculis capitus, vestimentorum, and pubis.* The general presence of *pediculus pubis* (crab lice) in camps in the United States, is exemplified, I believe, by a careful physical inspection of a division mobilized for border service, made during the summer of 1916, which revealed infestation as high as 40 per cent of certain regiments of apparently clean troops; where shower baths were well constructed and ample, the weather warm, and the standard latrine box, Quartermaster's Corps, was used and, ordinarily, well policed. The final report of the division surgeon was that the sanitation of the camp had been generally good throughout. The standard latrine box, Quartermaster Corps, having been supplied, it was impracticable then to obtain funds for the provision of a latrine cover which would prevent contagion. [2]

It may be well to state that it requires a sharp eye and careful searching at times to discover the *Pediculus pubis,* as it is almost transparent, and usually attached to the hair, head downwards, and close to the skin; in fact the nits are more easily seen than the insect itself, which latter will often be overlooked in the ordinary physical inspection, unless carefully scrutinized, or nits in numbers attract attention. Col. C. Y. Brownlee, M. C., U. S. A., expressed his opinion to me that the *pediculus pubis* is as guilty of carrying typhus fever infection, as the other two varieties of lice. The crab louse is not liable to cause the degree of itching that the body louse does; however, in this respect, it is to be likened to the venomous snake that does not warn before it strikes.

After nine months of further observation of the relative merits of the ordinary privy seat and the latrine for use in the squatting position, while on duty with troops at the beginning of construction of Fort Tilden, Rockaway Beach, N. Y., it appears that the results warrant an additional report. The apparatus has been improved through the necessities of local application and the principle is recommended, not as a makeshift to be used in conjunction with straddle trenches, but as a complete substitute for all forms of common privy seats in use by troops.

During the month of March, 1917, latrine covers with seats were constructed at this post by the post quartermaster, patterned somewhat after the Havard box latrine cover. They were made of white pine tongue and groove boards, 8 inches wide, which gave numerous cracks when completed and made effective scrubbing difficult, if not impossible. Shortly after their installation three cases of crab lice were discovered and although very radical anti-louse measures were carried out, the command was not freed of these vermin until the latrine covers mentioned were burned and a cover which could be used in a squatting position only was substituted. The soles of the shoes afford the point of rest instead of the naked buttocks, and the only other contact with the appliance is where the lid rests against the outside of the clothing, at the back. These latrine covers, which were installed in May, are at this date, November 26, 1917, still in use.

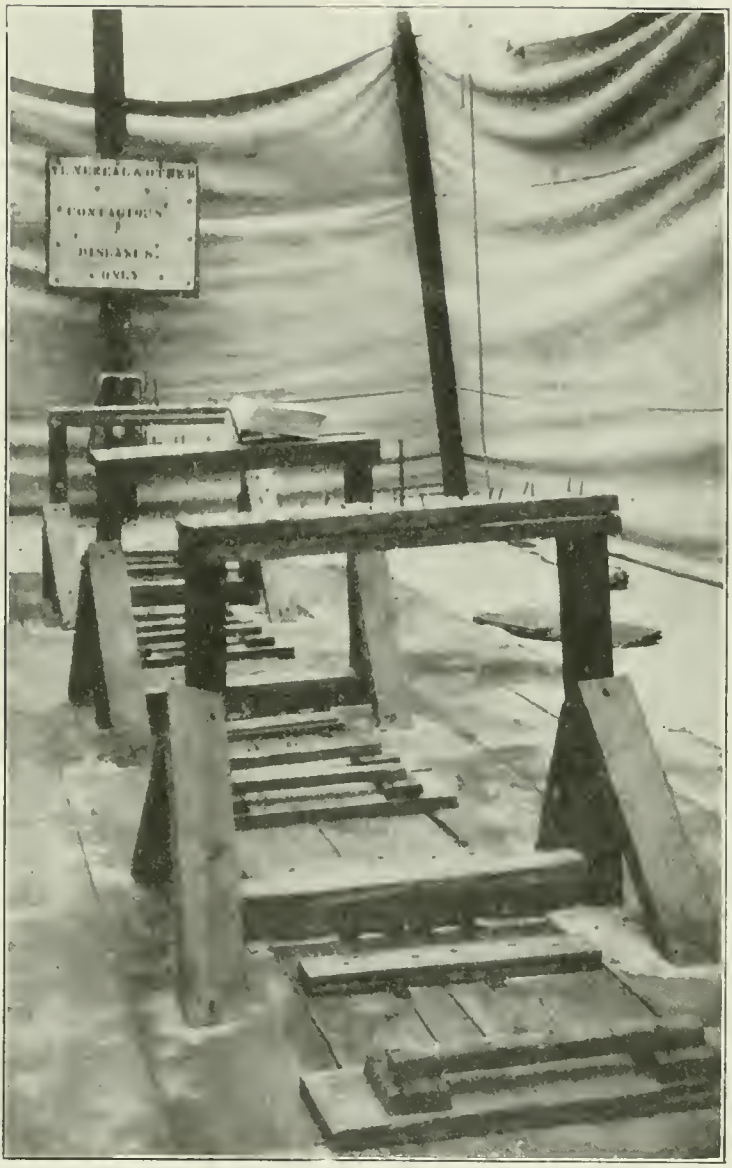
There has been one case of pediculosis (crab lice) at Fort Tilden during

[2] Lucas: A Straddle Trench Cover: MILITARY SURGEON, December, 1916.

the last seven months. This was a very exuberant infestation indeed and was apparently of some days' duration before discovery, judging by the number of vermin and nits. Two weeks since the last physical inspection, had elapsed when they were discovered and, if a few of these vermin were not present and overlooked at that examination, they must have been contracted very shortly afterwards. From past experience it is my opinion that this degree of infestation could not have remained confined to the single individual, if any ordinary common privy seat had been used under the existing conditions at this post. Not another case has appeared after twenty-four days, during which time two physical inspections have been made, and during which time delay in construction of the sewerage system, and cold weather has made bathing at this post almost impossible, at least in so far as the bathhouse is extemporaneous concerned.

Description of the Squat Latrine Cover.—Cuts of the cover, as previously described, are given in *Military Hygiene*, Havard, third revised edition, 1917, page 639, and THE MILITARY SURGEON, December, 1916, page 644. It was emphasized in my previous report (MILITARY SURGEON) that it is the principle of *no seat* that is the essence of the thing, and that many contrivances may be made to accomplish this equally well. My object in providing cuts is to exhibit forms of covers which have stood practical tests and developments to meet local conditions (see Figs. 1, 2, 3). Time, material and, at first, interest in the affair did not warrant as substantial construction of the covers requested, as desired, at Fort Tilden. Four boards of 6 inches, 1 inch, and 10 feet dimensions were supplied for each of the three companies, with sufficient 2 by 4 inch material, nails, hinges, and a handy man with tools. With these covers were constructed presenting five openings, about 2 feet long and 12 inches wide, with a 6-inch foot board extending along each side, held together and supported by the 2 by 4 stringers, which were placed so as to act as a stop at one end of the lids, and afford fastenings for two hinges at the other ends. An extra block of 2 by 4 was placed across the hinge anchors so as to give added strength to their fastenings and at the same time prevent the lids from opening to an angle beyond that which would cause them to close by gravity when disused. However, it was soon discovered that such great strain was exerted on the hinges and blocks by the leverage of the body weight, thrown back against the under side of the cover, when in use, as to loosen the fastenings. Sergt. Wm. D. Pitchford, 10th Company, C. A. C., S. N. Y., thereupon improvised the upright supports which are exhibited in the drawing and pictures. These covers now remain in place and have required slight repair to the present date, November 26, 1917. The pits are dug in the sand which tends to cave, for which reason the covers were widened by two boards on each side. These were placed over the regulation deep latrine pit which was subsequently built and cased up with boards. The pit of each of the three companies lasted for about four to six weeks, before it was necessary to provide others.

These covers reduce greatly the labor and attention ordinarily required for latrine policing. It is possible that some of the covers have been thoroughly scrubbed once or twice in the several months; nothing has been suggested as to this by the surgeon. The pictures were taken after months of use and exhibit



LUCAS LATRINE, COVERS CLOSED

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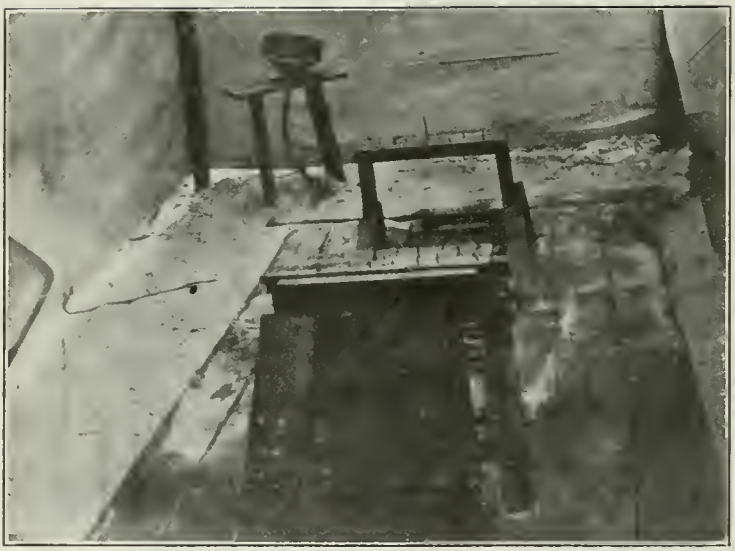
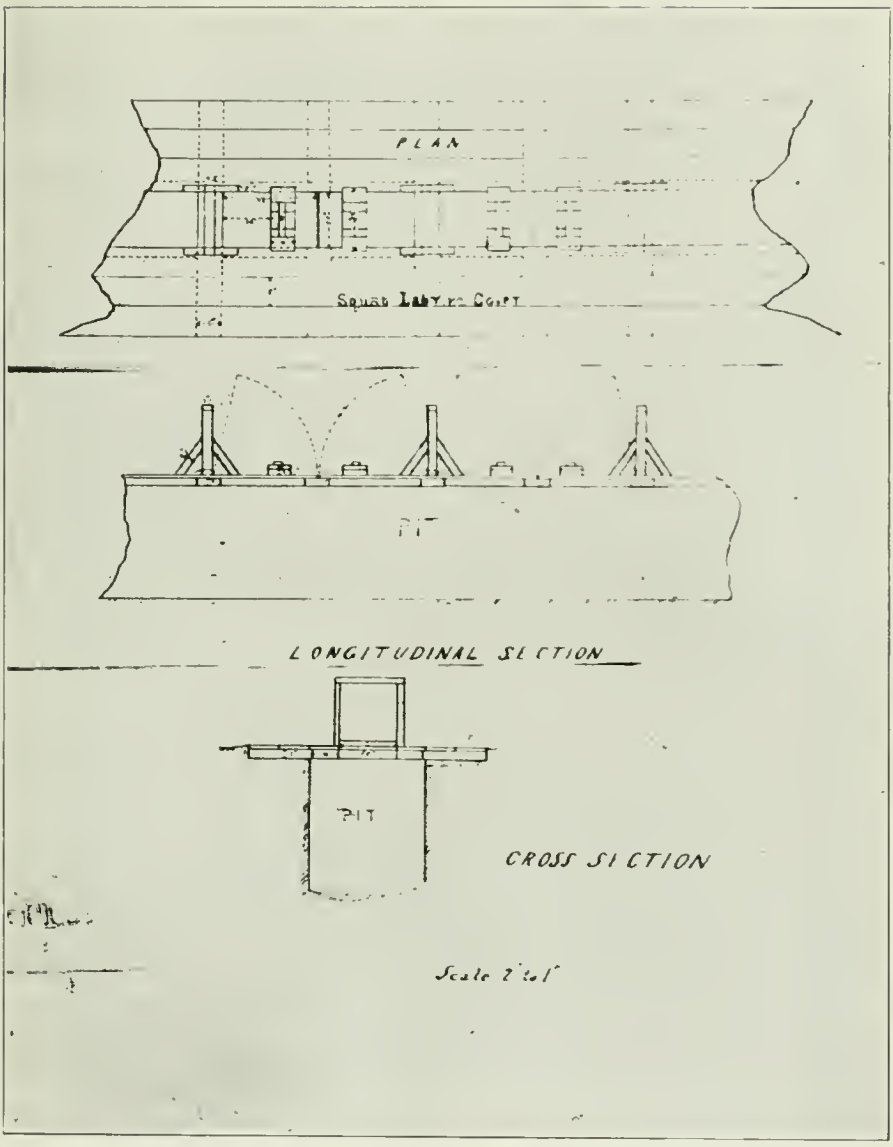


Lucas Latrine, Cover Raised. This Also Shows Wind


PLAN
Square Lady's Court
PIT
LONGITUDINAL SECTION
PIT
CROSS SECTION
Scale 2' to 1'

a fair representation of the condition they are in at this time. It is desirable to provide a separate urinal, for which purpose large gasoline funnels and a length of garden hose have answered admirably, one of which is shown in Fig. 3.

Under conditions as found at Fort Tilden, sand or earth, when piled upon the foot boards, is constantly kicked into the pit when it is being used, thereby covering the dejecta and giving a double automatic working guard against odors and flies.

Now that the semi-permanent bath house, with sewerage and running water and so-called modern privy seats, is almost completed at this post, we shall observe with interest whether this equipment is in the direction of better sanitation or otherwise.[3] While the modern toilet seat may be maintained in a perfectly hygienic condition, the question is, under the conditions which are prevalent in cantonments, will this be done? As to preference of the men for the seated and squatting position on the toilet, the presence of the fender rail which is necessary to force those using latrines to sit upon them, is evidence sufficient. I regret that provision, even in the new bath house at this post, of facilities so that the act of defecation could be accomplished in the squatting position, is not provided. I dare say that such provision would not only have been more economical, simple of installation and sanitary, but also preferred by the men. The few murmurs of dissent, when all seats were abolished from latrines on the reservation, quickly subsided when the reason for this innovation was understood. Even now, when there have been for the last months several privies with seats reinstalled on the reservation, I observe that the men purposely avoid them and go to the squat latrines, especially so when it is understood that Pvt. John Doe has developed a case of gonorrhea.

This report is made for two reasons: (1) It was not made clear in my first publication that the principle of squatting was the essential point, nor was sufficient emphasis placed on the applicability of the principle to all forms of public latrines. It is now apparent that, had my first article been entitled "A Squat Latrine Cover," instead of a "Straddle Trench Cover," the legend would more scientifically have portrayed the subject, and a certain amount of misunderstanding have been avoided. (2) It is apparent that this principle will remain only of local interest and effect until the Quartermaster Department becomes interested. In order to more readily interest this department of practical men, it may be well to mention that the top alone of the Quartermaster Corps standard latrine cover would afford approximately all of the material necessary for the construction of the entire squat latrine cover. A glance at the drawing of the Q. M. C. standard latrine cover is sufficient to show that substitution of the "squat" cover will save 75 per cent in lumber and furnish a far more sanitary appearance.

[3]A sergeant, who is a married man of excellent reputation, discovered that he was infested with crab lice within two weeks after the above-mentioned bath house was completed. There is now on the average 2 per cent of the command found to be infested with this vermin at each semi-monthly physical inspection. This, in spite of the fact that the commander became very much interested in prevention of such conditions at this post, and ordered two men as attendants to be in the bath house at all times, and that the officer of the day inspect the bath house at least five times in twenty-four hours to see that proper police of the seats is carried out. Of course, isolation of the infested cases is promptly instituted, the patients are shaved of all hair in the pubic and axillary regions, kerosene or mercurial ointment is applied, and frequent soap baths given.

A SURGICAL DUGOUT AND HOW TO VENTILATE IT[1]

Capt. Joseph Leidy, M. R. C., has devised a "dugout" and suggests the principle of ventilation and purification of air by the vacuum method, with view to gas protection, by using a slow suction fan, worked by the hand of an attendant with, or without, the use of an installed canister containing the neutralizing chemicals. The fan is placed in a pit before the blanket door at the front of a dugout as shown in the plan. Captain Leidy remarks that the plan was worked out by Lieut. Geo. Murphy, 105th Engineers, and suggests that this "becomes an additional means of protection to the surgeon and his assistants in the event of injury to their gas masks, or when necessary to change or repair a mask in an emergency;" but in no sense is to be considered as a substitute for the mask and blanket door.

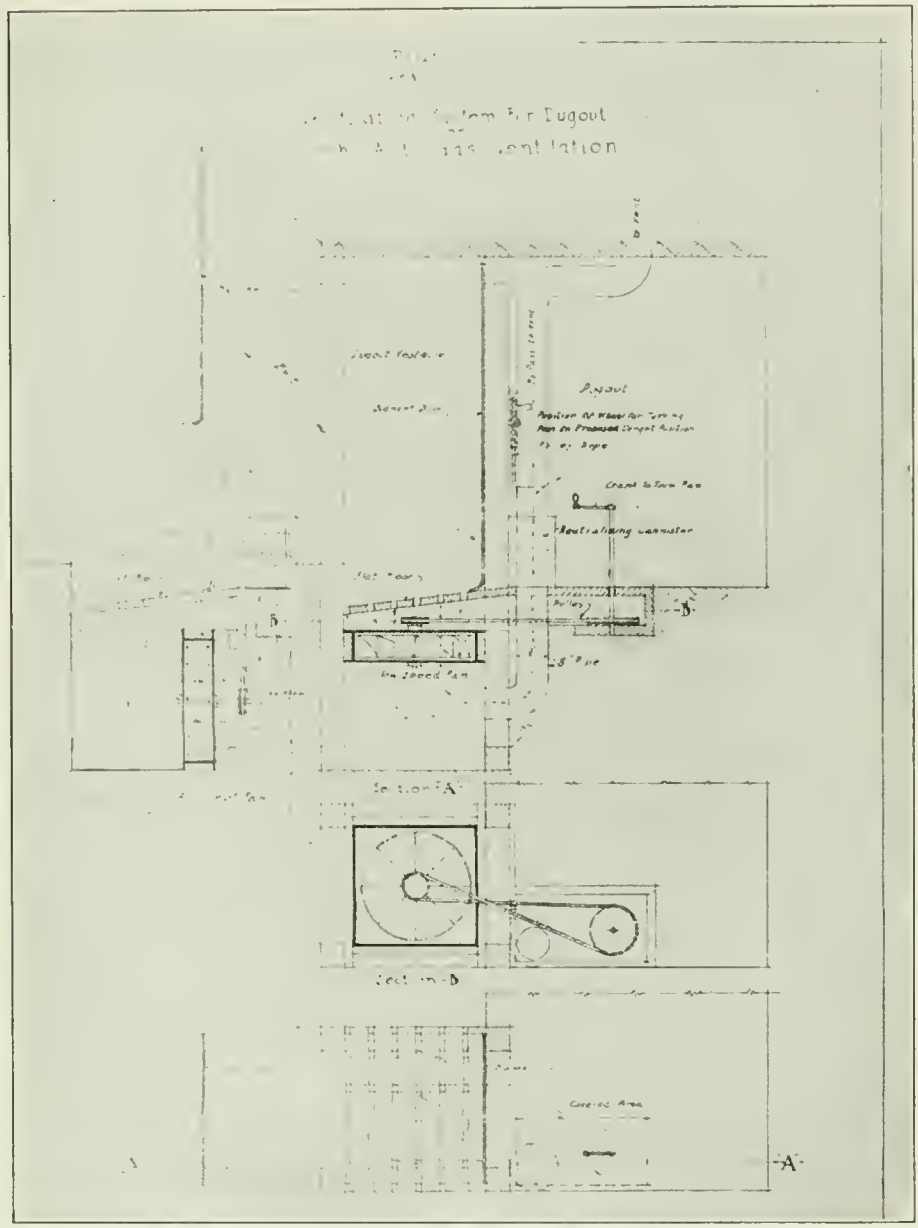
The writer has been led to this suggestion by reason of the fact that neither the French nor English instructors with the division with which he is serving have offered anything along these lines to meet an emergency. He adds in a note, "The trifling expense of the proposed system is not an unimportant factor in its installation, as such an apparatus could be made by a company carpenter."

It would appear that, like most things under the sun, this is not a wholly untried proposition, at least in part, as the French experimented with it, using 3 feet thicknesses of layers of earth and charcoal as the filtering media. Our Gas Defense Service says of the blanket door, when "properly made and there is a blanket inside of the first blanket, forming a vestibule, there is practically no leakage of gas and surgeons can work for hours. The slight quantities of gas which reach the entrance are mostly absorbed by the earthen walls of the passageways. It is possible for the air to become 'stale' in the dugout, but there is generally enough ventilation to provide sufficient air for good respiration."

Captain Leidy thus describes the operation of his dugout and trench ventilator:

> The accompanying print shows the ventilator at the entrance of a dugout, where it is assumed medical or other attention will require work without a mask and in territory where gas is present.
>
> The principle of operation is to produce a draft through the pit at the bottom of the stairway which would be the point at which gas would collect. The gased air from and above the pit would then pass through the pipe and up the ventilator; a bypass is provided in the pipe line, where air can be sent through a canister containing chemicals to absorb the gas, thus furnishing pure air for the room.

[1] With one illustration.



To face page 350.

The size of the fan and the pipe leading to the ventilator will be determined by the sectional area of the entrance and should be of a size sufficient to take care of an emergency—in other words, to be able to exhaust all the air which could pass the entrance.

The exhaust fan would be of light construction and produce the draft at a speed which could be operated by hand, as the plan shows, where power could not be obtained.

The vertical position of the fan is best suited for hand drive and offers advantages against dirt and refuse, carried on shoes from the trenches, passing through the fan.

The sketch was prepared to show the principle of operation and sizes would be best determined by experiment.

AN HISTORICAL EXHIBIT OF MILITARY MEDICINE

The opening of the exhibition of the collection of war specimens of the Royal Army Medical Corps at the Museum of the Royal College of Surgeons, London, on October 11, 1917, calls to mind the various collections of this kind made in the immediate past, and affords an unusual incentive to activities on the part of our own medical establishment as our forces come to play a more and more definite part on the Western front. We may recall with pride that one of the earliest—certainly the earliest large collection of this kind—originated with the circular issued by Surgeon General Hammond on May 21, 1862, establishing an Army Medical Museum at Washington and directing medical officers "diligently to collect and forward to the office of the Surgeon General all specimens of morbid anatomy, surgical or medical, which may be regarded as valuable, together with projectiles and foreign bodies removed, and such other matters as may prove of interest in the study of medicine and surgery." On January 10, 1863, Surgeon John S. Brinton, then Curator of the Army Medical Museum, was already in position to publish a catalogue of 959 specimens of gunshot fracture, 105 pathological specimens, 269 missiles, and 29 patterns of bayonets. A 664-page catalogue of the surgical section, prepared by Captain (now General) Alfred A. Woodhull, was published in 1866. The Museum now contains 47,681 specimens (June 30, 1917), and active preparations are now being made for the reception and cataloguing of specimens from the front to be collected by a special unit.

In 1810, some fifty-two years before our own Army Medical Museum was founded, British medical officers began to collect pathological specimens at Portsmouth, and, during 1810-11, about fifty preparations were put up at Hilsea Hospital. Nothing more was

done until 1816, when another beginning was made at York Hospital, Chelsea. At this time nearly all the Portsmouth preparations were found to be spoiled. The Chelsea preparations were then removed to the General Hospital at Fort Pitt, Chatham, and with this date (1816) the Museum of Royal Army Medical Department properly began. In 1833, a 269-page catalogue of the specimens, arranged in physiological series, was published. It was followed by later catalogues of 1838 (zoological specimens) and 1845 (pathological specimens). The museum was subsequently removed to Netley, and a catalogue of the pathological specimens was published in 1890 (3d ed., by Sir William Aitken, 1892). A catalogue of the Museum of Military Surgery, at Netley, was published in 1867. These collections are now in the Museum of the Royal Army Medical College, Millbank.

The present London exhibit occupies the three rooms in the Museum of the Royal College of Surgeons, which, in time of peace, contained the unique preparations made by John Hunter, now happily stored in sundry cellars, out of harm's way. The war exhibit is fittingly designed to be of the utmost practical use for object-teaching in military medicine and surgery. On entering Room 1, the first thing seen is the collection labeled "Means of Protection," *i. e.,* metal helmets, breast-plates, and various devices for gas defense. Then come the effect of bullets of high velocity on the skull, including bilateral injuries from the same bullet; gutter wounds and concealed injuries of the internal plate of the skull; fractured jaws, with dental splints attached; fissures of the vertebrae by explosive bullets; gunshot injuries of the ribs, sternum, upper extremities, sacrum, and pelvis; the "butterfly," or X-shaped fractures of the femur; injuries of the lower extremities, and multiple injuries. These specimens are all from the present war.

In Room 2, examples of gunshot wounds from Corunna, Waterloo, the Crimean, Austro-Prussian and Franco-Prussian wars are displayed, the wounds from shrapnel and shell wounds and their septic inflammatory sequelae being the same as now. The shattering, expansive, "explosive" effects of high-velocity missiles first appear in specimens from the Soudanese campaign of 1898. Near this historical series are specimens of modern rifle ammunition, Sir Victor Horsley's models showing the track of high-velocity bullets in soft clay, specimens of wounds of entrance, wounds of exit, wounds at various stages of healing or sepsis, the new wrinkle of "excised wounds," the manifold visceral lesions, the sequelae of wounds, and

specimens of successful surgical operations; also specimens of the drowning of the lungs by effusion from "gassing," the renal lesions in trench nephritis, and the gas gangrene produced by the Welch bacillus (*B. aërogenes*). On a screen nearby are the accurate bedside drawings of war wounds in pen and brush by Sergt. A. K. Maxwell, showing, among other things, the appearance of the muscles in various stages of gas gangrene.

Room 3 is an important exhibit of the graphics of war-time surgery. It contains Sir Charles Bell's drawings of wounds by gunshot, cannonshot, and *armes blanches* from Waterloo; Col. F. M. Caird's off-hand sketches of trench-foot, guillotine amputations and the effects of Yperite (from France), with plaster-casts, photographs, radiograms, and wax models of jaw-surgery, orthopedic surgery, models of fracture splints, casts of flat foot, deformities from nerve lesions and adaptation of stumps to artificial limbs. The collection is instructive as to the lines that may be taken in organizing our own graphic unit. The entire exhibit, as stated, is eminently practical in tendency, designed to orient medical officers as to conditions, rare in civil life, which may be encountered and must be dealt with, *e. g.*, concealed wounds, migration of bullets into the heart and elsewhere *via* the blood channels, fatal termination of fractures of the neck from diving, which might have been prevented by proper handling.

Another phase, that of books, pictures, and specimens illustrating the cultural development of military medicine, appears in the remarkable catalogues of the exhibitions given at Dresden (1911) and at Berlin at the opening of the war (1914). The historical section of the International Hygienic Exposition at Dresden in 1911 was a vast assemblage of some 20,394 items, representing every cultural phase of public and private hygiene, from remote antiquity down. Military medicine and hygiene were especially featured. Babylonian tents, Phoenician transport ships, a walled camp at Nineveh, vultures as natural scavengers of the battlefield, with burial of the dead in a common grave; bandaging scenes from Greek vases and Roman columns were shown, and, in the later period, the beginnings of definite uniforming in the sixteenth and seventeenth centuries; the *justaucorps* coats; the hot, heavy helmets, shakos and wigs; the narrow collars and chest-constricting knapsacks; camel transportation of the wounded in Egypt (1792); the fitful appearance of a "Red Cross" agreement at the Bridge of Lodi (1796); a bandaging scene at Essling (1805); transportation of the

wounded in the Napoleonic wars (1805–1815); a traveling kitchen (1806); three soldiers to a bed (1806); a ration list of 1810 (2 pounds bread, 2 measures of beer, 1 pound meat per man *per diem*); swimming schools for soldiers (1820–1826); an ambulance wagon of 1824; heavily wadded uniform coats of 1830–1850; sieve ventilation in barracks (1843), etc.

At the Berlin exhibit (1914), many objects illustrating field and naval sanitation, prevention of tuberculosis, military radiology, field dentistry, the technics of nursing, circulating libraries for soldiers in hospital, the care of war cripples, evacuation and care of the wounded, were contributed by the German military establishment and various commercial firms. The historical section comprised a number of figurations of wounded warriors from antique vases, statuary, frescoes, and sarcophagi; camp and battle scenes by mediaeval and modern artists; also different kinds of bandages from 1813 on, field-chests, sutures, letters and cacolets, military hospital appointments, surgical instruments, and artificial limbs.

Among the graphic items were a scene of carrying the wounded from a battlefield from an old Greek sarcophagus at Stamboul; Andrea della Croze's picture of the extracting of a bullet during a battle with the Turks (1605); the pictures of Ambroïse Paré on the battlefield by E. Hammann and L. Matout; the fantastic war scenes (*Los Desastres de la Guerra*) etched by F. Goya y Lucientes; Horace Vernet's "Wounded Soldiers," and many pictures of military medicine by German artists, such as the etchings of Chodowiecki, A. von Menzel's "Feldschers and Hussars," or M. von Schwindt's "Bandaging of a Wounded Soldier." There were also printed placards giving passages from the Iliad on the care of the wounded, the mandates of Queen Isabella of Spain for the maintenance of her field hospital (1487), Gersdorff's dictum, "No wine to the wounded" (1551), which marks a distinct break with the earlier practice of giving stimulating "wound-drinks," and placard citations showing the existence of five precursors of the Geneva Convention between 1743 and 1864.

In 1916, a collection of pathological specimens from the present war was instituted at the École d'Application du Service de Santé Militaire at Val de Grâce, as an annex to the Historical Museum of the Service de Santé, established at the same school in the late eighties. The latter consists of a large collection of historical archives, tablets, inscriptions, extracts from dispatches and pictures, with clay models of military posts and dressing stations,

model plans of hospitals and hospital trains, and specimens of stretchers and splints. The Pirogoff Museum, at Petrograd, established in memory of the great military surgeon who, in the words of Senn "was to Todleben what Larrey was to Napoleon Bonaparte," is mainly a repository of Pirogoff relics.

The glass-case exhibit of historical items recently prepared at the instance of Col. Champe C. McCulloch, Librarian, S. G. O., in the Library Hall, Army Medical Museum, is necessarily of more modest proportions, being restricted to items actually in the Surgeon General's Library. While the resources of the Library have not been greatly taxed thereby, it is believed that this small array of items affords a good illustration of the ups and downs of military medicine in the past and the present, for visiting medical officers. A catalogue raisonné of the same is subjoined.

I. Books illustrating the history and progress of Military Medicine:

Arnold of Villanova: Tractatus de regimine castra sequentium. 13th Century. *In his:* Praxis medicinalis. 4°. Leyden, 1786–87.

von Pfolspeundt (Heinrich): Buch der Bündth-Ertznei (1460). (Edited by H. Haeser and A. Middeldorpf). 8°. Berlin, 1868.

Brunschwig (Hieronymus): Buch der Wund-Artzency. 4°. Strassburg, 1497.

von Gerssdorff (Hans): Feltbuch der Wund-Artzeney. 8°. Strassburg, 1526.

Paré (Ambroise): La manière de traictes les playes faictes tant par hacquebuts, que par fleches. 8°. Paris, 1552.

Gale (Thomas): An excellent treatise of wounds, made with gonneshot. 4°. London, 1563.

Clowes (William): A prooved practise for all young chirurgians concerning burnings with gunpowder and wounds. 8°. London, 1591.

Fabry (Wilhelm) von Hilden: Feldt Artzney-Buch von Kranckheiten und Schäden. 12°. Basel, 1615.

————His experiments in Chyurgerie. 4°. London, 1643.

Minderer (Raimund): Medicina militaris. 12°. Ingolstadt, 1620.

Cober (Tobias): Observationum medicarum castrensium hungaricarum decades tres. 8°. Helmstadt, 1685. Contains the first note of the relation of pediculosis and typhus fever.

von Gehema (Jan Abraham): Der wohlversuchte Feld-Medicus. 16°. Rostock, 1689.

Purmann (Matthias Gottfred): Der rechte und wahrhaftige Feldscher. 12°. Frankfurt u. Leipzig, 1690.

Morbi castrenses: Various treatises of the 18th Century, bound in one volume. 4°.

Pringle (Sir John): Observations on the diseases of the army in camp and garrison. 8°. London, 1752.

de Meyserey: La médecine d'armée. 12°. Paris, 1754.

Van Swieten (Gerhard): Kurze Beschreibung und Heilungsart der Krankheiten, welche am öftesten in dem Feldlager beobachtet werden. 12°. Wien, Prag u. Triest, 1758.

Bilguer (Johann Ulric): Diss. inaug. med.-chir. de membrorum amputatione rarissime administranda aut quasi abroganda O. 4°. Halae Magdeb, 1761.

Brocklesby (Richard): Economical and medical observations in two parts, from the year 1758 to the year 1763, incl. etc. 8°. London, 1764.

Ravaton (Hughes): Chirurgie d'armée, ou traité des plaies d'armes à feu et d'armes blanches. 8°. Paris. 1768.

Colombier: Code de médecine militaire pour le service de terre. 12°. Paris, 1772.

Group of books and pamphlets relating to the medical conduct of the War of the Revolution:

Rules and articles for the better government of the troops, raised or to be raised and kept in pay by and at the expense of the Twelve United Colonies of North America. 8°. Philadelphia, 1775.

Jones (John): Plain concise practical remarks on the treatment of wounds and fractures. 8°. Philadelphia, 1776.

Van Swieten (Gerhard): The diseases incident to armies with the method of cure, translated from the original by J. Ranby. 8°. Philadelphia, 1776.

Morgan (John): A vindication of his public character in the station of Director-General of the military hospitals and Physician-in-chief to the Continental Army. 8°. Boston, 1777.

Rush (Benjamin): Directions for preserving the health of soldiers, addressed to the officers of the Army of the United States. 8°. (Philadelphia, 1777.)

Brown (William): Pharmacopoeia simpliciorum et efficaciorum in usum nosocomii militaris ad exercitum Foederatarum Americae civitatum. 8°. Philadelphiae, (1778).

Thacher (John): A military journal during the American Revolutionary War from 1775 to 1783. 8°. Boston, 1827.

Hunter (John): Observations on the diseases of the Army in Jamaica. 8°. London, 1788.

————Treatise on the blood, inflammation and gunshot wounds. 4°. London, 1791.

Percy (Pierre-François) le Baron (1754–1825). Manuel du chirurgien d'armée ou instruction de chirurgie militaire. 8°. Paris, 1792.

Blair (William): The soldier's friend, or, the means of preserving the health of military men. 16°. London, 1798.

Larrey (Dominique Jean) le Baron. Mémoires de chirurgie militaire et campagnes. 4v. 18°. Paris, 1812–17.

Goercke (Johann): Kurze Beschreibung der bei der Königl. Preuss. Armée stattfindenden Krankentransportmittel für die auf dem Schlachtfelde schwer Verwundeten. 4 copperplates. 8°. Berlin, 1814.

Guthrie (George John): On gunshot wounds of the extremities requiring the different operations of amputation. 8°. London, 1815.

Mann (James): Medical sketches of the campaigne of 1812–14. 8°. Dedham, 1816.

Beaumont (William): Autograph letter. November 1, 1825.

Cheyne (John): Letter to George Renny, Esq., M.D., Director General of Military Hospitals in Ireland, etc., on the feigned diseases of soldiers. 8°. Dublin, 1826.

Dupuytren (Guillaume): Traité théorique et pratique des blessures par armes de guerre. 2v. 8°. Paris, 1834.

Gavin (Hector): On the feigned and factitious diseases of soldiers and seamen. 8°. Edinburgh, 1838.

Luard (John): A history of the dress of the British soldier. 8°. London, 1852.

Stromeyer (Ludwig): Maximen der Kriegsheilkunde. 8°. Hannover, 1855.

Tripler (C. S.). Manual of the medical officer of the Army of the United States. Part I. Recruiting and the inspection of recruits. Cincinnati, 1858.

Group of books published in aid of the medical conduct of the Civil War. Of these books, only the flexibly bound surgical handbook of Stephen Smith (1862) passed through more than one edition, reaching its fifth edition in 1863.

Gross (Samuel David): A manual of military surgery. Philadelphia, 1861.

Tripler (Charles S.) and Blackman (G. C.): Handbook for the military surgeon. Cincinnati, 1861.

Chisholm (J. J.). A manual of military surgery for the use of Surgeons in the Confederate Army. Charleston, 1861.

Woodward (Joseph Janvier): The hospital steward's manual. Philadelphia, 1862.

————Outlines of the chief camp diseases of the United States armies. Philadelphia, 1863.

Smith (Stephen): Handbook of surgical operation. New York, 1862.

Bartholow (Roberts): A manual of instructions for enlisting and discharging soldiers. Philadelphia, 1863.
Hammond (William Alexander): A treatise on hygiene, with special reference to the military service. Philadelphia, 1863.
Mitchell (S. Weir), Morehouse (G. R.) and Keen (W. W.): Gunshot Wounds and other injuries of the nerves. Philadelphia, 1864.
Greenleaf (Charles R.): A manual for the medical officers of the United States Army. Philadelphia, 1864.
War Department, *Surgeon General's Office.* Circular No. 6. Reflex paralysis. (By S. Weir Mitchell, G. R. Morehouse and W. W. Keen, Jr.) Washington, 1864
Confederate States Medical and Surgical Journal. v. 1-2. Richmond, 1864-65.
War Department, *Surgeon General's Office.* Catalogue of the Surgeon General's Office Library. October 23, 1865. Washington, 1865.
Letterman (Jonathan): Medical recollections of the Army of the Potomac. New York, 1866.
War Department, *Surgeon General's Office.* Catalogue of the surgical section of the United States Army Medical Museum. Prepared by Alfred A. Woodhull. Washington, 1866.
Da Costa (Jacob M.). Observation on the diseases of the heart noticed among soldiers. 8°. New York, 1867. In: Flint's Contributions relating to the causation and prevention of disease, 360–382.
Flint (Austin): Contributions relating to the causation and prevention of disease and to camp diseases. New York, 1867.
War Department, *Surgeon General's Office.* List of works on military surgery in the Library of the Surgeon General's Office. August 20, 1869. Washington, 1869.
————Circular No. 4, 1870. A report on barracks and hospitals. By John S. Billings. Washington. 1870.
Mitchell (S. Weir): Injuries of nerves and their consequences. Philadelphia, 1872.
War Department, *Surgeon General's Office.* Circular No. 8, 1875. A report on the hygiene of the United States Army. By John S. Billings. Washington, 1875.
Dunant (J.Henri): Un souvenir de Solferino. 3. ed. Genève, 1863.
Pirogoff (Nikolai Ivanovich): Grundzüge der allgemeinen Kriegschirurgie. 8°. Leipzig, 1864.
Longmore (Sir Thomas): A treatise on the transport of sick and wounded troops. 8°. London, 1868.
von Esmarch (Friedrich): Der erste Verband auf dem Schlachtfelde. Kiel, 1869.
————Ueber Vorbereitung von Reserve-Lazaretten. Berlin, 1870.
————Handbuch der kriegschirurgischen Technik. 8°. Hannover, 1877.
Virchow (Rudolf): Ueber Hospitäler und Lazarette. Berlin, 1869.
————Ueber Lazarette und Baracken. 8°. Berlin, 1871.
————Die Fortschritte der Kriegsheilkunde. Berlin, 1874.
Lister (Joseph): Observations on ligatures of arteries. 8°. Edinburgh, 1870.
————On the effects of the antiseptic system of treatment upon the salubrity of a surgical hospital. 8°. Edinburgh, 1870.
Klebs (Edwin): Beiträge zur pathologischen Anatomie von Schusswunden. Leipzig, 1872.
Billroth (Theodor): Chirurgische Briefe aus den Kriegs-Lazarethen in Weissenburg und Mannheim, 1870. 8°. Berlin, 1872.
von Langenbeck (Bernhard): Chirurgische Beobachtungen aus dem Kriege. 8°. Berlin, 1874.
Laveran (Alphonse): Traité des maladies et épidémies des armées. Paris, 1875.
Toner (Joseph Meredith): The medical men of the Revolution with a brief history of the Medical Department of the Continental Army. 8°. Philadelphia, 1876.
Longmore (Sir Thomas): Gunshot injuries. 8°. London, 1877.
Woodhull (Alfred A.) Observations upon the medical department of the British Army, made in 1891. St. Louis, 1894.
Köhler (Albert): Grundriss der Geschichte der Kriegschirurgie. 8°. Berlin, 1901.
Pilcher (James Evelyn): The Surgeon Generals of the Army of the United States of America. Carlisle, Pa., 1905.
La Garde (Louis A.): Gunshot injuries. New York, 1914.
Canada. Regulations for the Canadian Medical Service, 1914. Ottawa, 1915.

GREAT BRITAIN. Army Medical Department. Memorandum on the treatment of injuries in war, based on experience of the present campaign. July, 1915. 16°. London, 1915.
LELEAN (P. S.): Sanitation in war. 8°. London, 1915.
SHIPLEY (A. E.): The minor horrors of war. 8°. London, 1916.
HAVARD (Valery): Military Hygiene. 8°. New York, 1917.
MUNSON (Edward L.): The Principles of Sanitary Tactics. 8°. Menasha, Wis., 1917.
————The Soldier's Foot (1912). 8°. Menasha, Wis., 1917.
JONES (Robert): Notes on military orthopedics. 8°. London, 1917.
CARREL (Alexis) AND DEHELLY (G.): Le traitément des plaies infectées. Paris, 1917.

II. Carte de visite photos of celebrated medical officers: Sir Thomas Longmore, Baron F. H. Larrey, Surg. Gen. Merchle (Belgium), B. von Langenbeck, A. von Bardeleben, W. Roth, F. von Esmarch, H. von Helmholtz, E. Gurlt.

Civil War Group:

J. S. Billings, C. S. Tripler, A. A. Woodhull, J. J. Woodward, Jonathan Letterman, T. A. McParlin, J. K. Barnes, S. Weir Mitchell, S. A. Green.

III. Photographs illustrating the history of Military Medicine.

1. Bandaging scene from an electron vase of the 4th century, B. C., excavated at Koul-oba in the Crimea. (Hermitage, Petrograd.) Period of non-specialization. (The army surgeon was also a warrior, possessing medical knowledge, transmitted by his ancestors.)

2. Plan of the Roman military hospital (Valetudinarium) at Carnuntum, near Vienna: first period of construction (beginning of 1st Century, A. D.). (Beginnings of organized medico-military administration. Each tactical unit and each war-ship had army surgeons).

3. Plan of Roman military hospital (Valetudinarium) at Novaesium (Neuss, Rhenish Prussia) (end of 1st Century, A. D.).

4. Plan of Roman military hospital (Valetudinarium) at Carnuntum, near Vienna; showing an entire change in design and construction; second period of construction (*circa* 167 A. D.).

5. Application of a bandage; relief from the Pillar of Trajan, Rome, representing the first battle with the Dacians at Tapae (101 A. D.). (In this period, each Roman legion had a complement of 20 army surgeons, uniformed like the rest of the troops, with the exception that the shield was not carried.)

6. Arrow-wounds of head, wrist and calf of leg, from Brunschwig's Book of Wound-Surgery. (Strassburg, 1497.)

7. Amputation, from Gersdorff's Field-Book of Wound-Surgery (Strassburg, 1517), showing constriction of blood-vessels above and below the site of election.

8. Extraction of an arrow in the field, from Gersdorff's Field-Book of Wound-Surgery (Strassburg, 1517).

9. Mutilation of prisoners and wounded after a battle (from Gottfried's Chronik, 1629).

10. Amputation, from Purmann's Chirurgia curiosa, showing the tight-waisted *justaucorps* coat worn by the 17th century army surgeon. (Actual specimens of this uniform were exhibited at Dresden in 1911.)

11. Amputation from Heister's Surgery (1718), showing the *justaucorps* coat worn by army surgeons in the 17th century.

12. Monument to Surgeon General Goercke (1750-1822), founder

of the Medico-Chirurgical Pepinière (1785), now the Kaiser-Wilhelms Akademie, Berlin. His grave is in the garden of the Academy.

13. Death of Marshal Lannes at the battle of Essling (May 29, 1809). He is supported by Napoleon himself, while Larrey attends to the shattered limbs.

14. Return of the wounded from the battle of Sidi-Mered (Algerian War, 1842) showing mule-transportation by means of litter and cacolet (pannier).

15. Médecin-inspecteur Sedillot, director of the École impériale de médecine militaire at Strassburg (1860-66).

16. Uniform of a pupil (medical cadet) at the École impériale de santé militaire, Strassburg 1861.

17. École impériale du service de santé militaire, Strassburg, 1856.

18. Photographs showing modes of bandaging the wounded (French Army).

19. Photographs showing modes of transporting the wounded (French Army).

20. Photograph of protective helmet (French Service).

21. "Les soldats de Reuilly." Post-card photographs of methods of reeducation of the blind. (France.)

IV. Objects from the front.

1. First aid packets used in English, French and German services.
2. Cake of ambrine (French Service).
3. Tetanus antitoxin: portable ampoule (German service).

F. H. Garrison.

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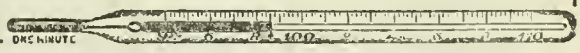

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CURRENT LITERATURE

The Improvement of War Bread by the Neutralization of Ferments in Bran, by Lapicgne and Legendre. Comptes Rendues des Séances de l'Académie des Sciences, t. clxiii, No. 9, 27 Aout, 1917, p. 316. (From "Office Internat. d'Hygiene Publique," t. ix, No. 9, September, 1917, p. 1181.)

The French have, perhaps always, enjoyed an enviable reputation of being the makers of excellent bread. We are, therefore, very apt to pay due attention to an announcement of still further improvement in breadmaking by them.

It has been known for some time that the scaly coverings of grain are not merely inert cellulose protective envelopes, but that they contain soluble ferments acting energetically on all the other panifiable substances which they enclose. The material that lends itself, more especially, for the study of these ferments may be obtained from mills and consists of those substances, intermediate between bran and flour, commonly known as gruel or "recoupettes," still obtained as a by product by certain millers, unable to improve their complicated machinery. This gruel, the color of which varies from gray to rose, is of a distinct acid reaction; when moistened, even with the addition of an antiseptic, such as toluene, these substances ferment energetically; when exposed to the vapors of ammonia, they change their color from brown to citron-yellow; the same color-change occurs on the addition of an alkali and, under the microscope, it is clearly seen that it is localized in the aleuron cells. Finally, the change in color is, likewise, seen in the watery extracts obtained from the gruel (*recoupettes*), and, after this turn in color has taken place, through the action of some alkali, such extracts have lost their noxious acid fermentative powers upon the flour. These principles having been worked out in the laboratory, our authors have endeavored to apply them in bakeries.

For practical as well as hygienic reasons, lime water was used as the alkali and thus several kilograms of bread were made in accordance with the following technic: 4,470 grams of flour à 76 (grain of La Plata) and 530 grams of gruel (*recoupettes*) of the same grain (gruel containing about one-third of bran, so-called); then a leaven was made with 1 kilogram of flour and 90 grams of yeast. While the leaven was in the process of rising, the 530 grams of gruel (*recoupettes*) were treated with lime water until the change in color occured, which took about 1½ liters; the leaven having reached the proper point, a paste was made with the remainder of the flour by first using the gruel, diluted with its lime water, then completing it by pouring ordinary water into it, until the desirable consistency of the paste was attained. The bread thus obtained was scarcely less brown than the ordinary bread made of the same flour but, in spite of the large amount of bran it contained, it was absolutely free from the acrity or tartness possessed by the latter. Other trials were attended by the same excellent results.

It must, of course, be admitted that breadmaking by the use of leaven is in itself a fundamentally favorable condition. The authors have caused to be

made a lot of breads (100 of 1,400 grams each), with a series of leavens, in the ordinary way except that the gruel, instead of being mixed with the flour, had first been treated as stated above. The results were excellent: bread of a sweet taste and odor, without acidity, and remaining unchanged, while the control-bread became moldy in five days.

It would, therefore, seem perfectly feasible to produce a bread, perfectly acceptable from all points of view, with a minimum of complication of the work and an expense practically nil and with a flour, deprived by the sieve, of but 15 per cent of its weight.

H. G. Beyer.

The Treatment of Diphtheria Bacillus Carriers by Insufflation of Powdered Antimicrobic Serum, by R. Bénard. *La Presse Medicale*, 17 May, 1917, p. 275. (From "Office International d'Hygiéne Publique," tome ix, No. 8, Augun, 1917, p. 1013), and **The Local Treatment of Diphtheria Bacillus Carriers,** by I. Roskam. Archives Medicales Belges, May, 1917, p. 406. (From "Office Internat. d'Hygiène Publique," tome ix, No. 9, September, 1917, p. 1129.)

Bénard, on comparing the results of treatment of bacillus carriers by the usual methods with those obtained by the method of insufflations with antidiphtheritic serum, extolled by the "Institut Pasteur," finds that the latter method is not only much more simple but brings about sterilization much more surely and rapidly than former methods.

The powder has the following composition: antidiphtheritic serum, 10 grams; novarsénobenzol Billon, 0.90 gr.; bezoin, 1 gr.; bismuthum carbonate, 100.00 grams. The insufflations are done three to four times daily.

With 15 cases of diphtheritic sore throat which the author had treated by injections of antidiphtheritic serum and, after their recovery from the disease, subjected to insufflations, their sojourn at the hospital did not exceed one month; in seven of the cases it amounted to less than two weeks. The treatment, therefore, absolutely eliminates convalescent carriers. As for "healthy carriers," out of 14 such isolated cases, 5 were discharged in less than one week, 8 in less than thirteen days and one only at the end of eighteen days.

The author then cites an experience of his, in 1916, at Nevers, where a special school had been formed in which all the juvenile bacillus carriers were collected and treated, amounting to 22 children; these were all discharged, after two negative tests, in 15 days. One of these children had been known as a bacillus carrier for six months and in whom the usual methods of treatment had not succeeded; she was completely free from germs in twelve days.

Roskam confirms the good effects of nasal and pharyngeal insufflations with pulverized antimicrobic serum (*mélange de pastilles* L. Martin of antimicrobic serum, pulverized, of arsénobenzol, of camphor, of talcum and of boric acid). The saving in mean time by the insufflation method, as compared with the usual antiseptic method, is 33 per cent for the convalescents and 59 per cent for healthy carriers.

H. G. Beyer.

ABSTRACTS FROM THE LITERATURE OF PLASTIC AND ORAL SURGERY

Office of the Surgeon General, United States Army

Section of Surgery of the Head

(*Concluded*)

PLASTIC SURGERY

1. Bryan, W. A. Plastic Surgery of the Face. *Brit. Dent. Jour.*, 1916, xxxvii, 229-232.

Traumatism is the most potent cause of failure in plastic and in all other kinds of surgery.

In facial repair, overdo the correction.

Apply no dressing to the wound.

The author refers to Horsley's transplantation of the anterior temporal artery. Flap is cut from the anterior temporal region and the anterior temporal artery with its veins is left attached to the flap and dissected out of its bed as far back as required. Wound closed and source of flap skin grafted if necessary. A new bed is made for the vessels by making an incision which leads from the point of exit of the vessels to the edge of the defect. Vessels placed in incision and covered by suture. Flap sutured in position.

2. Babcock, W. W. Osteoplastic Surgery of the Face. *Jour. A. M. A.*, 1915, lxiv, 203.

Transplantation of free fat from patient's abdominal wall. The cutaneous incision need not be large, and should be placed, if possible, at some inconspicuous point. Subcutaneous tissues separated by a knife, and tunneling with blunt pointed scissors. After arresting hemorrhage, bits of fat of sufficient size are introduced and held in the pocket by subcutaneous sutures of fine catgut. Usually undesirable to suture fat in position. The fat is introduced in small portions or strips may be obtained from adjacent subcutaneous tissues. In small defects, local anesthesia may be used.

3. Esserer, J. F. Studies in Plastic Surgery of the Face. *Annals of Surgery*, March, 1917.

I. *Use of Skin from the Neck to Replace Face Defects.*—The incision for upper lip-cheek defects vary, according to the size and position of the defect. They have all the same principle, that the facial artery lies in the center of the flap, and the upper part of the incision first rises, then makes a broken curve, passing under the ear and extending more or less on to the neck, according to the size of the defect. The lower end of the cut is always vertical, so as to make the whole flap quite movable. After making the flap as movable as required, it is then turned and placed in the defect. The cut varies according to the presence or absence of hair, and also if the defect extends to the eyelid. A somewhat similar incision is necessary in the mucous membrane of the mouth, commencing at the same place and running in the same direction, but turning before reaching Steno's duct. At the end of this cut is also a sudden vertical incision to facilitate its mobility. The cut in the mucous membrane is not only important for mobilization of the whole flap but also a surplus of mucous membrane is thus supplied for the inside of the new lip. The first part of the cut may split the entire cheek, but farther on it must be gradually less deep for fear of injuring the facial nerve or Steno's duct. Ample nourishment for the flap is supplied by the facial artery. Tension is greatest at the neck. A secondary defect, after the primary defect is closed, will be seen by a gap in the neck. The posterior wound edge is then diminished in length by sewing the edge together at the cut intervals. These stitches can bear great tension. In this manner the back edge is made to approach the front one, till they can be easily sewn together. No part is ever left unclosed.

The apparent danger of injuring Steno's duct and the facial nerve is very small, if careful technique be used. As no dressing is employed, any disturbance at once becomes apparent. Sometimes small salivary fistulas appear, which heal in a few days, without the use of silver nitrate stick. The latter is to be avoided as it leaves scars. In such cases, after thoroughly cleaning with ether, two drops of collodion are placed on the fistula, and as soon as the liquid is nearly dry, a little cotton is pressed with the finger for some moments on the fistula. If pus has collected under the cotton by the next day, the collodion is taken off until the wound becomes clean. This collodion treatment is repeated until healing occurs. Most of these fistulae heal easily because because they are due to injury of the gland tissue and not of the duct.

II. *Plastic Operations about the Mouth.*—Defects of the lower lip.

The technique consists of taking a more or less highly pointed triangular flap with the pedicle below. The flap is taken either from the naso-labial fold, or also extends higher up between the nose and the cheek. When mucous membrane is required, the cuts penetrate into the mouth, otherwise more or less muscular tissue is included in the flap, according to the requirements for active movement in the under lip. After first complete closure of the naso-labial defect, the flap is ready to be placed in the under lip. The flap is used either to fill a defect, or, if the lip be too short or too immovable, is placed in an incision between the red border of the lip and the skin.

The advantages of this method are the following:

1. The flap contains the entire angular artery.
2. The flap may, if required, supply excellently functioning muscle tissue (levator anguli oris) for moving the under lip.
3. The suture line of the secondary defect disappears exactly in the naso-labial fold.
4. The upper line of the flap always forms the natural vermilion border of the lip. Only the much shortened lower suture line remains visible after the operation.

III. *Epidermic Inlay in Combination with Dental Modelling Composition.*—The bad results of Thiersch skin grafting are largely due to irregular growing together of the skin and the grafts, with the formation of scars in the granulating surface.

Means were sought for applying the Thiersch evenly, and maintaining it immovable under equal pressure for some days on the wound. The Thiersch must be everywhere of the same thickness, and equally stretched on the impression form, before this is placed on the wound. After creating aseptic hollows, by cutting under the normal skin adjoining the wound, and after lifting and exactly filling up this with an accurate mold of dental modelling composition, completely surrounded with Thiersch (the raw surface of the Thiersch outward), the equal pressure is brought about by suturing the incision under firm tension. To prevent infection, the greatest care must be taken in preparing the Thiersch. This must be very thin, and as far as possible free from dead cells which are always infected. Therefore, the inner side of the upper arm only is used, because the skin is thinnest and most elastic there, and the part is prepared thoroughly and most carefully, till the skin is pink everywhere. A Thiersch of suitable size and of even thickness can only be cut with regular success after great practice; one must always get a tough, perfectly transparent piece of skin, the thinner the better, especially when it must replace the mucous membrane.

The types of cases in which this method is serviceable are:

1. Enlargement of the conjunctival sac.
2. Construction of part or entire ear.
3. Enlargement of mucous membrane of the mouth.
4. Enlargement of the mouth cavity.
5. Defect of the hard and soft palate.
6. Covering of various forms of skin flaps.

1. *The enlargement of the conjunctival sac* is often required to make room for an artificial eye. In these cases the eyelid skin is cut parallel to the eye-slit, above or below, according to the case. Scars must generally be removed. After lifting the upper part of the cut, an impression can be taken with the sterilized modeling composition. This, after hardening, is carefully covered in the manner described, with very thin Thiersch, and is then placed in the wound, which is closed under tension. The mold must be made of such size and shape as to produce sufficient tension on sewing the wound together. Before cutting the Thiersch, which only is done when everything has been prepared to receive it immediately, without first placing it in physiological saline solution, the hard mould shold be placed in the hollow and the

incision pressed together with the fingers, to see if the tension is correct, otherwise the mould can be altered. It is not practical to enlarge it by adding to it, as the joint leaves a line where the Thiersch later falls in. It is better to make a new mould if the first proves too small. It is possible to decrease the size of the mold if too large, by cutting it before it is quite hard, and smoothing the cut portion. Closure under pressure by suture is necessary for two reasons—first, the Thiersch is subjected to evenly distributed pressure which favors rapid healing, and second, possible bleeding is prevented. The hollows are formed by *cutting*, purposely to open the largest number of small blood and lymph vessels, as better healing is thus promoted. By suturing under pressure, the small vessels are all closed—only the large arteries must be clamped or twisted, but not tied, as no foreign substance must remain between inlay and wound. In consequence of the pressure, a primary healing of the suture is not certain, but this is of little consequence. After about two weeks, the conjunctival sac is cut parallel to the eye-slit, and at a point where the inlay is nearest to the surface. The mould is removed and the smoothly healed hollow is joined to the eye-slit in order to receive the artificial eye, which must be inserted immediately, so that the elastic hollow can adapt itself to the form of the prosthesis.

2. *With ear defects*, a longer or a shorter cut, according to the size of the defect, is made exactly along the hair line, behind the ear. The skin in front with the periosteum is raised as far as the ear, and above and below as far as necessary to obtain sufficient tissue for the defect. The mold of modelling composition is made of the hollow behind the flap, and after hardening, covered with Thiersch, replaced, and the wound edges sutured. In all cases in which this method is employed it is important that the bottom of the wound be made as flat as possible so that the Thiersch can be laid quite smoothly on the mold—and as the thin skin is very elastic this can be done without folds, though a fold would not prevent success. In very difficult cases, especially when deep tunnels with small openings are to be covered with epithelium and where the Thiersch-covered mold must be pushed in with difficulty and under pressure, the Thiersch may be stuck on the mold with white of egg. The white of egg disappears quickly and makes it possible to remove the mold after one or two weeks without bringing away the Thiersch with it. In the ear cases the sutures are removed after one week, the cut is again opened some days later, the mold removed, the hollow laid completely open, from behind, and this cut enlarged from above and below, till the flap is so movable that it can be used for a plastic of the ear. By this method we have two advantages (1) the flap is already accommodated to its new pedicle nourishment, and (2) the flap is completely covered with skin at the back, and the place from where it was taken also.

3. *Enlargement of the Mucous Membrane of the Mouth.*—This is often desirable after jaw injuries or in patients, who, after extensive inflammation have suffered scarring, with contraction of the mucous membrane. In these cases a vertical incision is made in the skin of the middle of the lip and prepared from there to the left and right, under the skin for two or three inches and a width, of ¾ inch, two hollows being thus formed which are filled with modelling composition covered with Thiersch in the manner above described. Two weeks later a cut is made inside the mouth, over the thinnest covering of the composition, and after removing the inlay, the cavity is laid quite open with the scissors. An impression of the jaw may be immediately taken, which was impossible before the operation, owing to the adhesions, and an artificial denture can be made and inserted to replace any lost teeth. The lip, formerly quite immovable, at once regains its use.

4. *Enlargement of the mouth cavity* can be carried out in the same way as with the eye and ear cases. After removal of the scar, a cross cut is made, and a space formed which is filled with a mold of composition, covered with Thiersch, and sewn together. Here, as in all such intra-oral plastic cases, a layer of iodine gauze is put between the composition and the Thiersch. A frequently occurring indication for this procedure lies in large bone defects of the center of the lower jaw, the so-called "bird-face." By cutting the outer skin, all scars are completely removed and then, by internal enlargement through the outer cut, a cavity is formed by pushing the jaw pieces apart until the normal jaw line is obtained. This is not always possible without cutting the mucous membrane vertically. When the elasticity of the membrane allows this opening is sewn together horizontally, otherwise it is closed with a flap, or left open, as an uncovered epidermic inlay, even in the mouth, may heal, but this is not quite certain. The cavity is filled with modelling composition covered with Thiersch, which is removed ten days later by cutting on it inside the mouth. The

opening is enlarged with scissors, as described above and the dentist immediately takes an impression and prepares a temporary prosthesis without teeth. This is exchanged later for a permanent prosthesis with teeth. This prosthesis has to perform the following uses: to fill up the cavity, giving normal anatomical lines, and to support and connect the jaw into a continuous piece. The appearance of the patient is thus rendered quite normal, and a bone graft can later be inserted, the tissues through their stretching and accommodation to normal position offering better conditions for this than before.

5. *Defects of the Palate.*—Even though these defects be of very large dimensions, this procedure is of great value. The mode of procedure is similar to that of Lane, but is an improvement in that raw surfaces are immediately covered with epithelium. According to the size of the defect, at a greater or less distance from it, a curved incision is made on the alveolar process, through gum and periosteum, and a sufficiently large flap raised. Between this and the bone, the impression material covered with Thiersch on both sides is placed, and the edge of the flap sutured back in place. At a second operation, after one or two weeks, the line of suture is opened, enlarged above and below, the mold removed and the flap turned over and the edge after freshening, inserted under the edge of the mucous membrane on the other side of the defect.

In carrying out the epidermic inlay method of grafting, the following points are to be especially borne in mind:

1. Care must be taken in the formation of the cavity, if this is to be opened elsewhere than the line of suture, as for example, in the mouth, that at the point of secondary opening the covering be as thin as possible. Also the bottom of the cavity must be as flat as possible so that the Thiersch may be inserted without creases. The space should in a measure be funnel-shaped, *i. e.*, without undercuts, so that the impressions may be removed and inserted easily. Although a perforation of the wall must be carefully avoided, the Thiersch can bear much exposure to infection.

2. The skin should be prepared only with tincture of iodine, and other moisture carefully avoided. The skin is to be freed of all dead cells by thorough shaving without soap or moisture, and then the Thiersch cut of an even thinness, in one piece of the required size. It is important to cut the Thiersch immediately before inserting in the cavity, avoiding the use of salt solution, and to insert it before the raw surface becomes dry.

3. The mold should be very exact, and of such a size that the edges of the wound can be brought together, though it is of no essential disadvantage if the suture line gaps a little.

4. The sutures must be strong, and deeply taken so that they do not tear out too soon.

Application of Thiersch as a substitute for mucous membrane has an advantage over the whole skin with its glands, etc., in that it accommodates itself more easily to the mucous membrane conditions. The whole skin under such conditions goes through a long stage of inflammation or eczema, while the Thiersch only shows a strong scaling in the mouth at the beginning.

4. Esser, J. F. S. Plastic Work on the Face. *Surgery, Gynecology and Obstetrics*, 1917, xxiv, 437.

The writer prefers to cover defects of the face with tissue from the immediate neighborhood. Avoids, if possible, the application of pedicle flaps from a distance. The first consideration in plastics of the face is the good appearance of the patient. The muscles of expression must be considered, fat tissue must be provided. The skin to be used must be chosen so that it closely resembles the skin of the area to be covered, in color, shade, elasticity, thickness, direction of its fibers, hair, number and size of pores. The most essential principle is simplicity. The use of skin from nearby surfaces is preferred to skin from distant parts. In almost every instance, even in very large defects, this principle can be carried out. The one point necessary is that the parts be made sufficiently movable, either by cutting on one side—half pedicled or when necessary, with entire pedicles. The general opinion that this causes deformities is false.

When the wound edges have fallen in, leaving a depression, the fat and muscle tissue are undercut and brought together by layers of sutures in a ridge exactly beneath the suture line. Strict asepsis must be observed. Before operation the skin

is shaved using no moisture, and then painted with tincture of iodine. The skin is kept as dry as possible during the operation.

Local or regional anesthesia used. As small a quantity of the anesthetic solution sa possible is used, and injected into rather than around the edges of the wound.

The greatest care is used in the total excision of all superficial and deep scars.

No tension in the skin is allowed, all tension being borne by hidden deep sutures.

After the operation calomel powder is dusted on and around the wound, which is left uncovered. The sutures enter not toward the wound edge but perpendicularly or receding from the edge. The knots are placed to one side of the incision.

The wounds must be kept absolutely immobilized. The patients are forbidden to speak or move the lips. Liquid diet is given through a rubber tube.

Classification of simple face plastics.

1. Simple lineal seam:
   (*a*) After scar excision
   (*b*) After scar and skin excision.
2. Complicated lineal seam:
   (*a*) With underlay from direct neighborhood
   (*b*) With underlay of free transplanted fat.
   (*c*) With alteration of skeleton.
3. Seam with displacement of one wound flap after mobilization by simple cut:
   (*a*) With very large basis.
   (*b*) With narrow pedicle.
   (*c*) With island flap.
4. Seam after mobilization of both flaps.

5. Grant, W. W. Cancer of the Lip. *Jour. A. M. A.*, 1916, lxvi, 1368.

Plastic operation after resection of cancer of lip. (Applicable to defects following injuries.)

The defect is made to assume rectangular shape.

From lower angles of rectangle, incisions are made obliquely downward and outward, dividing all tissues, including mucous membrane and crossing mandible at a point equidistant between the angle and the symphysis and carried back beneath the mandible as far as necessary. The cheeks are then separated from the mandible at least as far back as the masseter muscles if necessary. The facial arteries are cut. The flaps are then brought forward and united to each other with silkworm gut in the middle line. If there is much tension, tie a mattress suture over gauze at the line of union of flaps. Stitches of silkworm gut are placed in the lateral incisions and should include the entire thickness of the cheek. It is sometimes necessary to enlarge the mouth by an incision backward and slightly downward from each angle of the mouth down to the buccal mucous membrane, and the latter separated from the overlying tissues above and below the incision to the extent of ½-inch. The lip above and below is now beveled from the inner border of the incision to facilitate the easy covering of the lips by mucous membrane which is now divided with scissors nearly to the angle of the skin incision and united to the skin with a running suture of chromic gut. A small rubber drain is inserted from the posterior angle of each lateral incision beneath the mandible and a "T" drain through a submental incision, (when necessary), into the mouth, under the tip of the tongue. The "T" end rests behind the incisor teeth, and the outer end is fixed by a safety pin. This drain limits soiling of the wound with saliva.

The same principle of incision applies to defects of the upper lip.

The fact that the deformity may be distinctly to one side of the mouth does not in the least alter the principle of the incisions, the flap from the opposite side will simply be longer.

The covering of the flaps and the vermilion border with mucous membrane is essential to prevent disfiguring constriction.

After-treatment.—The first dressing is changed in 24 to 36 hours, and is repeated thus for a week. The mouth is irrigated through the "T" tube as well as through the mouth, with warm boric and normal salt.

Patient is nourished through feeding tube until the stitches are removed (a week or ten days).

6. Horsley, J. S. Plastic Operations for Acquired Deformities of the Face. *Jour. A. M. A.*, 1916, lxvi, 411-414.

Dressing After Operation: Dust with boric acid powder and leave open. If there is much oozing, a compress of dry gauze is applied for a few hours. When any of the cavities of the face are involved in the wound, hexamethylenamine is given before and after operation.

For large defects of the cheek, transplantation of the anterior temporal artery with frontal flap seems desirable. Artery is dissected with considerable tissue around it and transplanted to a new bed by an incision that merely goes through the skin and not deep enough to sever branches of the facial nerve. The skin is undermined on each side so as to cover the artery without tension. The flap is stabbed in several places to facilitate oozing of blood and prevent congestion. In transplanting pedicled flaps, leave the pedicle about two weeks.

7. Imbert, L., and Lheureux, C. Uranoplasty for an Oblique Loss of Palatine Substance. *Marseille Med.*, 1916, liii, 81-85.

The flaps, instead of being in the classical antero-posterior direction were transverse. Transverse incisions were made about 1 cm. on each side of the break which was oblique. Flaps were raised from the bony vault, and the edges freshened and approximated. Silk sutures were used. A vulcanite plate was attached to the teeth to immobilize the parts and protect them from trauma, food, etc.

8. Morestin, H. Palatine Defect Covered at the Expense of the Mucous Membrane of the Cheek. *Bull. et mem. Soc. de Chir. de Paris*, 1916, xlii, 1711.

In this case there was a large loss of substance of the palatine vault, putting the mouth in communication with the nasal fossae. It was situated on the right side at the union of the hard with the soft palate. It extended from the median line, which it crossed slightly to the left, as far as the alveolar border which it reached behind the second upper molar, the third molar having disappeared. It occupied more than 2 cm. in its transverse diameter, about 15 mm. in its antero-posterior diameter. It was ovoid with the long axis oblique from in front backward, and from left to right. From its right edge extended a very strong cicatricial band of a pearly white end which descended toward the cheek and ended on the external surface of the mandible at the level of the last molar. The orifice of exit of the projectile left a depressed and adherent scar at the angle of the mandible.

Operation Under Local Anesthesia by Cocain Infiltration.—The edges of the opening were freshened, followed by resection of the buccal part of the ring to allow of entrance of the flap. The fibro-mucous tissue was liberated with the elevator to the extent of about 2 cm. in front of the perforation and on the left side. Behind, the mucosa of the soft palate was liberated also to a sufficient extent. The fibrous palato-buccal band was then excised. In the mucous membrane of the cheek a large flap was cut whose pedicle corresponded to the gingivo-buccal groove at the level of the second upper molar, and whose point was found immediately behind the labial commissure. The upper border of this flap grazed the opening of Steno's duct. The flap was dissected free with scissors. When detached in all its extent, it was turned inwards, placed in the area of lost substance and fixed with horsehair sutures throughout its circumference.

The flap had good vitality, preserved a good appearance and was under no tension. The wound from which the flap was borrowed could be reunited almost completely.

The results of the operation were perfect. The flap united by primary intention. The sutures were removed from the sixth to the eighth day. The patient has overcome difficulty of alimentation and expresses himself in a natural voice. Care is taken that he carries out exercises for making supple the muscles of mastication and for spreading the jaws. He already opens the mouth very widely and the contriction of the jaws will in all probability be almost entirely overcome.

9. Pietri, P. Autoplasty of the Face According to the Method of Professor Moure. *Presse Medicale*, July, 1917, p. 388.

The originality of the method of Moure consists in the utilization of the subjacent fatty pannicule, exposed, doubled, turned back according to the Indian

method and employed as a padding just as in the case of the free fat graft. The procedure is especially useful in the repair of wounds situated in the temporal, buccal and submaxillary regions. The fat employed in the cheek region is taken from the fatty pad of Bichat, occupying the space between the masseter and the buccinator.

It is necessary to disinfect the wounds, to extract splinters, and wait until healing is complete.

In the case of cicatrized wounds, the patient is submitted to treatment with hot air and massage in order to try to give to the traumatized tissues the suppleness that they have lost. Massage and hot air augment circulatory activity and nutrition of the tissues. In many cases this treatment suffices without surgery.

Local anesthesia always gives excellent results and it is unnecessary to resort to general anesthesia in employing the method.

10. Von Hacker. The Plastics of Penetrating Cheek Defects Due to Gunshot Injuries. *Beitr. z klin. Chir.*, 1916, xcviii, 289.

First Stage: Flap cut from cheek down neck commencing close to defect but in such a way that a strip of skin is left between defect and flap. This strip is termed the bridge. The flap, which hangs from the cheek, is turned over, passed *under* the bridge, and part of it covered over the defect. This is sutured to the edges of the defect and the former outer skin surface of the flap thus forms the interior lining of the mouth at the defect. The edges of the flap site are approximated.

Second Stage: This takes place when the flap has healed in the defect. It consists in severing the lower edge of the bridge and with this, and the unused portion of the turned over skin flap, patching over the external surface of the defect and approximating the edges.

SALIVARY GLANDS AND DUCTS

1. Blair, V. P. Septic Parotitis. *Medicine and Surgery*, 1917, i, 34.

In discussing the similarity of biliary duct disease and inflammation of the salivary ducts, the point is brought out that probably stone irritation and obstruction is the cause of the intermittent enlargements of the gland, and that simple subactute or chronic inflammation without stone is not very common. Stones in the parotid ducts are much more difficult to demonstrate than those in the submaxillary ducts. While there are two theories of acute infection of the glands, especially in the parotid, (1) metastatic, and (2) due to ascending infection of the excretory ducts—the author contends that neither of these has been demonstrated beyond dispute.

The treatment of acute septic parotitis is described in detail, special emphasis being placed on early radical operative procedure. Special stress is placed on extensive incision through the capsule, allowing the gland to expand and exploration of the gland for pus, especially the prolongation that runs along the duct.

2. Crouse, H. New Technique for Operations on Steno's Duct. *Surgery, Gynecology and Obstetrics*, 1915, xx, 593.

Technique is as follows: Incision made over cheek 2 cm. below and parallel to zygomatic process, 2 cm. in front of ear; incision about 3 cm, in length, simply cutting through skin and adipose tissue of cheek; fascia of parotid incised and exposed for about 1 cm. parallel to skin incision; lip is grasped and cheek turned out; a pointed strip of buccal mucous membrane ¼-inch wide and ⅛-inch deep is marked off commencing slightly within the vermilion border line of upper lip stripping the same back slightly posterior to or even with the cusp of second molar tooth, leaving posterior end of strip thicker than anterior end and unseparated. Mucous strip is clipped with curved scissors, care being taken to cut deep enough so that its vitality is not impaired. This strip is tagged with an artery forceps. Next, a Doyen or similar forceps is passed through the external cheek wound over the surface of the masseter to its anterior border; buccinator is punctured and mouth entered just in front of posterior end of area denuded by buccal mucous membrane, strip forceps are widely stretched; mucous strip caught, drawn into cheek wound and sutured with No. 0 ten day chromic catgut, similar to Lembert's intestinal suture, making a double tie leaving the ends long, in order to secure the loop of No. 5 ten day chromic gut, the ends of the latter remaining in the mouth; skin wound is sutured subcuticularly, the mucous membrane strip being whipped together with small chromic gut.

3. Lilienthal, H. A Method of Incising Parotid Abscess without Injury to the Facial Nerve Distribution. *Amer. Jour. Surg.*, 1917, xxxi, 101.

Instead of the long painful wait for something to happen, when suppuration has been recognized in the parotid gland, the author offers prompt relief by an incision, which he claims permits of free drainage and the avoidance of unsightly scars as well as injury to important branches of the facial nerve.

A description of his method is as follows:

A vertical skin-deep incision is made in front of the auricle and just as close to it as possible; this is extended to the hollow behind the angle of the jaw, and thence in a gentle curve forward as far as the projection of the anterior border of the masseter muscle; the flap of skin thus formed is reflected forward, revealing the greater part of the parotid gland and its overlying fat and fascia. The incisions, as many as are necessary for drainage, may now be made through the parotid fascia into the gland itself, the line radiating in a general way along the course of the pes anserinus. No incision, however, should cross the line of Stenson's duct for fear of salivary fistula. Deeper collections of pus may be evacuated through this same cutaneous incision by puncturing through the fascia, behind the ramus of the jaw and then enlarging the opening with the director and dressing forceps.

The opening into the parotid may be packed or otherwise drained, the skin flap not being replaced until healing is well advanced, when it may be held in position with adhesive strips.

4. Morestin, H. Treatment of Salivary Fistulae Consecutive to War Wounds. *Bull. et mem. Soc. de Chir. de Paris*, 1917, xliii, 835.

Since the beginning of 1915, Morestin has treated 62 salivary fistulae, 30 being glandular, and 32 fistulae of Stenson's duct. Of the glandular fistulae 6 were cured after treatment by the thermocautery; 26 were extirpated; 24 were cured without the least accident.

In the fistulae of Stenson's duct, the author thinks that the best treatment in many cases is obliteration of the duct, which naturally comprises physiological suppression of the corresponding parotid gland. Although this is a very radical procedure, he is led to it by several considerations, as he has found in the patients treated, that reimplantation of the duct after elimination of the fistulized portion was impossible, and internal drainage pure and simple rarely utilizable. Extirpation of the fistulized tract is therefore imposed as an absolute necessity. His procedure, then, is to extirpate Stenson's duct, ligature its stump at its origin, and obtain reunion without drainage. Obliteration of the canal brings about rapid physiological death of the parotid gland, but Morestin says that this has no perceptible effect on the organism. In 16 cases, an incomplete eradication of the canal was done with establishment of drainage toward the buccal vestibule. All recovered, and as far as Morestin knows, the fistulae has been cured, but he cannot say with certainty that an artificial canal was not established in any of these cases.

In 13 cases the complete radical operation was done with excellent results, and Morestin now employs the method exclusively.

The general conclusion drawn is that when such a fistula does not spontaneously close, the most general and most essential indication from the point of view of operative technique is to extirpate with the greatest care, at the same time as the fistulous tract, the whole of the fibrous tissue through which it runs, so that only supple and healthy tissues are left. In glandular fistula, suture and hermetic sealing of the glandular walls suffice to occlude the salivary orifice.

ANESTHESIA

1. Thoma, K. H. Extraoral Conductive Anesthesia for Oral Surgical Operations *Am. Jour. Surg.*, 1917, xxxi, 14.

Preanesthetic medication always indicated.

Main divisions of fifth nerve reached at foramina of exit by usual routes.

Mandibular Anesthesia at Mandibular Foramen.—Extraoral pterygomandibular method.

Indicated whenever the intraoral method cannot be used, as is often the case in fractures of the mandible and trismus of the muscles of mastication.

Landmarks.—Line drawn from tragus of ear to a point marked by anterior

margin of masseter muscle and lower border of mandible. The point where the ramus is divided into two halves, marks the projection of the mandibular foramen on the skin. The place to insert the needle is the inner side of the lower border of the mandible, 2 cm. anterior to the angle of the ramus.

Position of Left Hand for Injection of Right Side.—Place index finger behind, and parallel, with posterior border of ramus, the thumb in same direction, its tip touching lower border of ramus.

Position of Right Hand for Injection on Left Side.—Arm passed around patient's head, thumb placed behind posterior border of ramus and index finger bent around angle of ramus. Head bent toward opposite side. Dismounted needle is now inserted at point described. Advance in parallel direction to posterior border of ramus, marked on left side by the thumb and on the right side by the index finger.

After the needle has been inserted about 4 cm., we are in the pterygomandibular space, and as the direction of the needle is parallel with the nerve it does not matter if the needle is inserted a little too far. Inject 2 c.c. Anesthesia takes effect in fifteen minutes.

Failures.—The advance of the needle may find bony resistance in the depth of 3 cm. This comes from false direction of the needle point, striking a well marked internal oblique line. The needle may strike bone at once, which may indicate a well-marked protuberance for the attachment of the pterygoid muscle. These mistakes are remedied by changing the direction of the needle.

MISCELLANEOUS

1. Bowlby, Sir A. The Development of British Surgery at the Front. *Brit. Med. Jour.*, June 2, 1917, p. 705.

The following table was compiled by Captain Hey, Surgical Specialist at one of the forward Casualty Clearing Stations, and includes a period of heavy fighting during a recent battle. The length of time covered by the figures is not specified.

Table of Operations Performed at a Casualty Clearing Station

A. Ligature of arteries		277
B. Treatment of fractures:		
Skull	189	
Vertebrae	18	
Humerus	298	
Forearm	133	
Femur	299	
Leg	309	
Jaws	38	
Various	119	
Total		1,403
C. For treatment of joints		247
D. Amputations		431
E. Wounds of abdomen, drainage of pleura, etc		280
F. Excision and cleansing of wounds:		
Head and neck	95	
Trunk	309	
Upper limb	249	
Lower limb	765	
Multiple	398	
Total		1,816
The total number of operations performed for gunshot wounds amounts to		4,454
Total number of wounded admitted		20,589

Special Hospitals for Head Cases.—It has been found advisable to retain a considerable number of these cases near the front either in stationary or general hospitals,

or else in a casualty clearing station of the reserve. They do not need the immediate operations required for abdominal cases, and are consequently provided for farther back.

It is now the custom of all casualty clearing stations to dress their patients in large reception huts or tents as soon as they arrive, and to distribute them from this place as quickly as possible: (1) for immediate evacuation, (2) for retention, (3) for operation. In the first class are included chiefly the slightly wounded. In the second class are patients suffering from shock, from the effects of bleeding, from wounds of the lung, exposure to cold, etc. In the third class are all serious wounds of the soft tissues which require thorough dressing and especially lacerated wounds due to shells and bombs; most fractures; many injuries of vessels; all perforating abdominal wounds, etc.

The proportion of cases requiring operations to the whole number of wounded will depend on many conditions—for example, the larger the proportion of shell wounds to bullet wounds, the larger the number requiring operation and if a train is waiting to go to the base, men may be sent by it who would require operation if they had to be kept for 36 hours.

2. D. (W. H.). Report of the Dusseldorf Hospital for Injuries of the Jaws. *Brit. Dent. Jour.*, Lond., 1917, xxxviii, 98-100.

Report compiled by Professor Bruhn, comprising work from August 15, 1914 to August 15, 1916. At latter date, hospital consisted of 550 beds, besides accommodation for medical and nursing staffs—several buildings. In each 2 operating rooms, one for septic and one for aseptic cases. Also dental operating rooms, with necessary chairs, etc., and mechanical laboratories, kitchens, etc. Each building has a dental surgeon, 3 to 5 assistant dental surgeons, 2 to 4 mechanics, a clerk, masseur, matron, nurses, etc. Probably 5 dental surgeons, 18 assistant dental surgeons, 12 to 16 mechanics.

Two surgeons are attached and one physician and specialists for nerve diseases, eye, nose and throat.

During the period under review, 1,748 soldiers were admitted, 19 of which were prisoners and 62 officers. Of these, 1,081 were discharged, 210 fit for service, 481 fit for garrison duty; but of these 173 would be fit for field service when elsewhere the necessary dentures were provided; 12 were fit for work; 7 were unfit, 2 on account of jaw injuries, 5 on account of other injuries or diseases; 360 were sent to other hospitals; 9 patients died; 652 remained in the hospital. Ratio of injuries of maxilla, of mandible, and of both together, is roughly as 1:5:1. By far largest number due to rifle bullets, those due to shell fragments next, and then those due to shrapnel. Of the fractures, 167 were simple, 694 complicated and in 369 there was loss of substance. Of these patients 306 had gunshot injuries elsewhere. List of operations includes 907 plastics and 205 bone grafts on mandible.

Feeding and Diet.—Diet divided into 3 groups, fluid, minced and ordinary. Work provided for convalescents.

3. Fisher, A. R. Chloramine in the Treatment of Wounds of the Mouth and Jaws. *Brit. Med. Jour.*, January 15, 1916, p. 87.

A 2 per cent aqueous solution was used.

The usual surgical procedures were carried out under an anesthetic, such as opening up of external wounds, removal of loose bone, teeth, foreign bodies and jagged portions of tissue, arrest of hemorrhage and suturing of the severed tissues. Small drainage tubes were inserted through the wounds and the mouth to allow the access of the fluid to all the damaged surfaces. The distal ends of the tubes were allowed to project outside the bandage so that the reagent could be introduced frequently without disturbing the dressing. Irrigation was carried out every hour during the day and as often as possible during the night, the patient sitting up in bed. Three or four syringefuls (2 oz. capacity) were injected through each tube, the fluid returning through the mouth into a receptacle. The patient was fed through a tube, irrigation with the chloramine being carried out immediately before and after.

Under this treatment, the wounds healed rapidly and the fetid suppuration characteristic of extensive mouth wounds was conspicuously absent.

4. Kazanjian, V. H., and Burrows, H. The Treatment of Hemorrhage Caused by Gunshot Wounds of the Face and Jaws. *Brit. Jour. Surg.*, July, 1917, p. 126.

The paper is compiled from records of 400 cases of gunshot wounds of the face with fracture of the jaws.

Frequency and Time of Hemorrhage.—Of a total of 34 mild and serious hemorrhages occurring among the 400 cases (8.5 per cent), 16 required operative measures for controlling the bleeding under a general anesthetic, while the remaining 17 were successfully treated by packing, clamping, or by the use of a local anesthetic for ligation of the bleeding point. One case died suddenly from very profuse hemorrhage.

The majority of secondary hemorrhages took place between the fourth and twelfth days after injury, three between the thirteen and nineteenth days, and only one after this period, viz., on the forty-fifth day. Most of the secondary hemorrhages appeared during the night or early afternoon, *i. e.*, during the hours of sleep.

Sources of Hemorrhage.—It is not always possible to determine the artery which is responsible. Injuries to the superior maxilla and other bones of the upper half of the face are often accompanied by nasal bleeding from the deeper structures, which arises probably from the branches of the internal maxillary artery. Among 91 cases of fracture of the upper jaw, there were 4 hemorrhages; in 3 of these, hemorrhage was easily controlled by packing, while in the remaining one it was persistent and recurrent. Hemorrhage from the main trunk of the internal maxillary artery is rarely or never met with.

In 7 cases of extensive laceration of the face, bleeding from the mouth has occurred. In all the hemorrhage was superficial, with the source of the bleeding exposed, and it was stopped by packing, by the application of clamps or by immediate ligation of the vessel under a local anesthetic.

In those cases where the wounds are below or behind the angle of the lower jaw and involve the pharyngeal cavity and the neck, it is difficult to decide by internal examination which side is responsible for the bleeding. Two out of three such cases of hemorrhage from the pharynx were fatal.

Bleeding which occurs as the result of an extensive wound of the molar and bicuspid region of the lower jaw and accompanying injury of the floor of the mouth, usually arises from the lingual artery or its branches. Such cases have been most common—17 out of 34. Twelve of those required operative means of control under a general anesthetic.

Certain cases which presage hemorrhage from the lingual artery have recognizable characteristics. The wounds of entrance and exit are usually small, and situated in the vicinity of the posterior half of the lower jaw. The tongue is perforated, often dark purple in color, and swollen to twice or three times its normal size, so that the mouth is held open and the tongue protrudes beyond the lips. The jaw is fractured bilaterally, and the anterior segment shows a pronounced downward displacement.

On the other hand, large wounds anterior to the bicuspid region are unlikely to presage serious hemorrhage, since the area affected is supplied only by smaller vessels.

Extensive injuries, with destruction of the hard or soft tissues, but which are open, are less prone to bleed, because the free drainage forestalls the spread of sepsis.

TREATMENT

1. *Preventive Treatment.*—Thorough cleansing of the wound and mouth and temporary support of the fractured jaw, are measures that will very greatly reduce the tendency to secondary hemorrhage from sepsis. Temporary support may be brought about by the Barton bandage, Angle's bands, or wiring of the teeth. Dental splints should be used as early as the patient's condition will permit.

2. *Immediate Treatment.*—The seepage of arterial blood, which in most cases precedes a serious hemorrhage, is almost the only anticipatory indication of value. The exact area from which bleeding might be expected should be considered beforehand.

In the event of an emergency, the tray used in the ward for dressings may be depleted at the moment when it is most wanted, and therefore a separate one should always be kept in readiness with swabs, ribbon gauze, artery clamps, sinus forceps, dental mouth mirrors, a head mirror, adrenalin chloride, hydrogen peroxide, etc.

As soon as the hemorrhage appears, the attending nurse should send for the medical officer, and while awaiting his arrival, should syringe the patient's mouth with peroxide and attempt to control the bleeding with digital pressure. The patient should be kept sitting in bed against a back rest, to facilitate the work, to reduce the blood pressure in the head, and to prevent the flow of irrigating solutions and blood into the throat. The use of hydrogen peroxide gives a clean field of operation in the shortest time and acts to a slight degree as a hemostatic. Following this, the area is swabbed rapidly and that part from which blood issues is packed tightly with gauze soaked in adrenalin chloride.

As an adjunct to packing, a specially devised clamp will be found useful. This consists of a heavy piece of wire from 8 to 10 inches long, bent to a "U" shape with a finger or pad of dental modelling composition or vulcanite rubber on each end. The clamp is adapted by bending it so that one end passes over the packing, the other presses externally at a corresponding point under the chin between the hyoid bone and the lingual aspect of the mandible. Ligatures or elastic bands about the arms of the clamp will give the desired amount of pressure. A clamp of similar pattern, but of reduced dimensions, serves for the arrest of hemorrhage from the facial artery, exactly as one would pinch it with the thumb on the cheek and the forefinger inside the mouth. Even though the act of packing may not be the final means of stopping the hemorrhage, nevertheless it must be carried out to control it for the moment and to minimize the chances of recurrence before ligation is effected.

3. *Operative Treatment.*—In cases where packing the wound is not sufficient to control the hemorrhage, three courses are open for consideration, viz.:

(1) Ligation of the responsible vessel at the bleeding point; (2) ligation of the vessel at some spot proximal to the bleeding point; (3) ligation of the external carotid artery.

Ligation of the common carotid artery is not included as one of the available measures because of its uncertainty in arresting the hemorrhage and on account of serious interference with the cerebral circulation.

(1) *Ligation of the Bleeding Point.*—The first proposal is to find and secure the bleeding point, which is available in certain cases, most of which are of lesser severity. The following are the four varieties of cases in which an endeavor to secure the bleeding point is the correct practice.

(*a*) *Those in which the bleeding is external.*—Here the blood is not effused into the mouth, and the injured vessel may be sought for without any invasion of the buccal cavity. Injury of the facial artery, or one of its branches, submental or coronary, provided most of the examples.

(*b*) *Intrabuccal hemorrhage of small volume.*—In these cases the bleeding is not sufficiently profuse to obscure the field of operation, or cause much harm to the patient if allowed to continue during a brief local investigation. Such a hemorrhage may come from an artery of the frenum of the tongue, one of the palatine arteries, or some other small branch of the lingual, faciae, or internal maxillary.

(*c*) *Copious hemorrhage from the free portion of the tongue.*—This arises from the ranine artery, and the bleeding is often alarming, owing to the abundant flow. Temporary arrest, however, may be effected readily by placing a pad of gauze under the tongue, and pressing the tongue on the pad by means of a finger held firmly on the dorsum. The artery is easily accessible from the mouth for purposes of ligation.

(*d*) Profuse intrabuccal hemorrhage from the floor of the mouth when the face is opened sufficiently to allow a good view of the deep tissues at the base of the tongue. These cases are not common. The bleeding point can be looked for directly, because of the open nature of the wound. Another favorable feature is that the effused blood flows freely from the buccal cavity owing to the wide extent of the injury, and so does not cause the special difficulties that arise from the presence of a continual well of blood in the mouth.

One occasional source of difficulty in all these emergencies lies in the cessation of the hemorrhage during operation; a contingency that is to be expected if local anesthesia be used, but which sometimes takes place also with general anesthesia. Even rubbing the wound with gauze or other local stimulation may fail to reproduce the bleeding, with the result that the offending vessel cannot be located. Accurate observation of the wound while bleeding is still in progress may do something to mitigate this annoyance, but even careful preliminary investigation will not enable us always to avoid failure from this obstacle. The only remedy left is to examine

the wound for any adherent clot and, by tracing it gently and minutely, endeavor to find the vessel from which it has originated.

(2) *Ligation of the Bleeding Artery at a Point Proximal to the Injury.*—In the majority of cases of profuse intrabuccal hemorrhage from the floor of the mouth, ligation of the bleeding point is impracticable. The next plan is to secure the injured artery at some point proximal to the seat of trauma. The chief difficulty here is to recognize which artery is responsible. We have to consider eight possible sources, four on each side—lingual, facial, inferior dental, and lastly the external carotoid itself, with its tonsillar, pharyngeal, and other branches. In some cases, *e. g.*, in a through and through wound about the angles of the lower jaw, with small entrance and exit openings, we cannot definitely exclude any of these. We are often even unable to determine from which side the hemorrhage comes. Attempts to settle this question by alternate digital compression of the carotids in the neck, generally fail. Anatomical considerations founded upon the situation of the wounds and the track of the main projectile are often vitiated by the fact that the bullet or a fragment of shell converts pieces of bone and teeth into secondary projectiles, which scatter and so cause damage to structures lying away from the main path. Simultaneous damage to two or more arteries may be another confusing complication. Broadly speaking (*a*) bleeding from the floor of the mouth comes from one or both lingual arteries or their branches; (*b*) bleeding from between the fragments of a broken lower jaw arises from the inferior dental; (*c*) bleeding from the cheek or lip has its origin in a branch of the facial; (*d*) bleeding from the pharyngeal and tonsillar regions will call for ligation of the external carotid artery. The fracture and comminution of the jaw bone and swelling of the tongue and soft tissues increase the difficulty of approximate localization of the bleeding point. To avoid these difficulties, the authors adopted the course of ligating the external carotid in all doubtful cases; but before long they reverted to the former practice of ligating, if possible, the individual artery involved. Ligation of the external carotid in these cases of extensive injury to the jaw, face and neck is attended by considerable difficulty and danger. Moreover profuse recurrent hemorrhage from the floor of the mouth nearly always arises from one or both lingual arteries or their branches. The procedure therefore in all copious hemorrhages from this latter area, occurring in connection with gunshot wounds of the lower jaw, is to ligate one or both lingual arteries, provided the anatomical conditions are compatible with a wound of these vessels.

To assume that the lingual is the source and to act on this assumption may seem on first thought to be unsound. However, improved results and lowered mortality more than justify the practice.

TABLE OF COMPARATIVE RESULTS

Artery ligated	*No. of cases*	*Deaths*	*Mortality Per cent*
External carotid	10	5	50
Lingual	6	1	16.6

(3) *Ligation of the External Carotid Artery.*—This is used as a final resort, and does not always dispose of the danger of bleeding, owing to anastomosis and injury of a vessel of the opposite side. Moreover, in the presence of compound fracture of the lower jaw, due to a gunshot injury, ligation of this artery is a dangerous procedure.

OPERATIVE TECNIQUE

1. *Hemorrhage from the Inferior Dental Artery* is usually controlled by packing. Access may also be had if necessary by trephining the ramus of the lower jaw.

2. *Ligation of the Lingual Artery.*—Even in bleeding from the third portion of the lingual artery, with the exception of that from the free ranine artery, the hemorrhage should be controlled by ligation of the lingual artery, in its first or second portions, by a neck incision. In gunshot injuries of this region, special difficulties may be created by the displacement of the broken jaw, and the swelling of the neighboring structures lessens the freedom and ease of exposing the lingual artery. The submaxillary and lymphatic glands are apt to form a solid unyielding mass which lies in the way of a good view of the lingual artery. In some such cases retraction of these structures is unavailing and it will then be found of great assistance to resect them, a maneuver

that does not materially lengthen the operation, while it greatly facilitates exposure of the lingual artery in the second portion. Better exposure can be had if the assistant presses the hyoid bone up into the wound from the opposite side.

3. *The External Carotid* should be tied high so as to avoid thrombosis and embolism in the common carotid.

In these operations, inhalation broncho-pneumonia is guarded against by the employment of local anesthesia as far as possible, and using morphine sparingly.

General Anesthesia.—The main precautions to be observed are (1) avoidance of inhalation of septic material from the mouth into the respiratory passages. This is guarded against by cleansing the patient's mouth and irrigating with antiseptic solution, immediately prior to administration of the anesthetic, one hour before operation, 1-100 gr. atropine is given hypodermically to lessen the flow of saliva. (2) Provision of a perfectly free airway for the patient, so that there will be no violent efforts to breathe, and no unnecessary engorgement of the veins of the neck to increase the length and difficulty of the operation. To these ends the authors employ pharyngeal anesthesia through intranasal tubes, the back part of the mouth being packed with gauze. Of the 34 cases of secondary hemorrhage, 7 died.

5. Lewisohn. Method of Sodium Citrate Blood Transfusion. *J. A. M. A.*, March 17, 1917, p. 826.

Lewisohn's experiments have shown that 0.2 per cent of sodium citrate in blood is sufficient to prevent coagulation outside the body for 2 or 3 days. Five grams of sodium citrate represents the largest amount that can be safely introduced into an adult. 1,000 c.c. of blood containing 0.2 per cent citrate only represents 2 grams of sodium citrate. The technique employed by Lewisohn is most simple.

1. *Obtaining the Blood from the Donor.*—A tourniquet is applied to the donor's arm and one of the veins at the bend of the elbow punctured. A large canula is used, so the blood will flow rapidly. The blood is allowed to fall into a graduated glass jar which contains 2 per cent sodium citrate solution, in quantity necessary to make a 0.2 per cent solution in the amount of blood to be given. For example, if we want to give 450 c.c. of blood, we add this to 50 c.c. of the 2 per cent citrate solution. The blood is well stirred as it falls into the jar. Care must be taken never to have less than 0.2 per cent of sodium citrate or the blood will coagulate. A slight surplus of citrate solution will prevent this and can be added with perfect safety.

2. *Infusion of Blood into the Recipient.*—The citrated blood is either administered through a funnel or transferred to a glass infusion jar. The patient's vein usually has to be exposed through a small incision. The canula is inserted and attached to a funnel or infusion jar which contains 20 or 30 c.c. of physiologic saline solution. The citrated blood is then poured into this receptacle and allowed to flow into the vein by gravitation.

Before resorting to transfusion in any case, whenever possible, a Wassermann test must be made in the donor, and the blood of the donor and recipient must be tested for agglutination and haemolysis. Neglect of these precautions may bring disastrous results.

The simplicity of Lewisohn's technique renders it available to all, and makes it superior to all other methods of transfusion either direct or indirect.

6. Luc. Tracheotomy. *Presse Medicale*, 1916.

Instruments required: Bistoury, grooved director, scissors, one-half dozen hemostats, pair of broad retractors, narrower retractor to apply to the inferior angle of the wound, tracheotomy tube. Local anesthesia.

(*a*) Place a hard pillow not under the neck, but under the shoulders of the patient so as to make prominent the anterior cervical region.

(*b*) Have a trustworthy assistant attend to the head. The position of the head in extension, ideal for the making prominent of the region and for the discovery of the trachea, is unhappily difficult to keep for a patient more or less dyspneic. It is indispensable then that every time the patient shows a pressing need for air, the assistant charged with holding the head shall lift it up for a few instants.

(*c*) Carefully mark the cartilages of the larynx. Whilst for the performance of the operation proper, it will be indicated to place oneself to the right of the patient, we recommend a situation to the left for execution of the maneuvers of the local anesthesia, the syringe being much easier to manage from this side, above all if

care is taken to strongly lift up the skin pinched between the thumb and index finger of the left hand. One per cent novocain and adrenalin are used. The injections are made first intradermically on the line of the projected incision, then under the skin and in contact with the trachea. After this a massage is executed for all the infiltrated region to diffuse the liquid. Wait five minutes. Incision is made in the median line—not too low, *i. e.*, commence at superior border of cricoid and downward about 5 cm. Have assistant at the same time retract equally with the two hands. Be sure to keep in the median line. After denuding the cricoid, extend the denudation with the grooved director downward to the upper part of the trachea. When the first ring of the trachea becomes perceptible to the touch, apply to the inferior angle of the wound the narrow retractor and make marked traction from above downwards. This lays bare the trachea to a sufficient extent. The bistoury is then plunged through the tracheal wall, the back of the blade applied against the retractor and the rings incised from below upward. It is only after the tube has been introduced and fixed that the retractor is withdrawn. One or two sutures are inserted above the tube.

7. Makins, Sir G. H. Development of British Surgery in the Hospitals on the Lines of Communication in France. *Brit. Med. Jour.*, June 16, 1917, p. 789.

Wound treatment.—No difference of opinion exists on two points:

1. The urgency of an efficient primary mechanical cleansing and exposure of the wound cavity.

2. The importance of maintaining the wounded part at rest.

Speaking generally, if the primary mechanical cleansing of the wound has been thoroughly carried out, no further gross intervention should be necessary. Every hour of delay in this first treatment, adds to the subsequent task of dealing with the infection.

In considering the advisability of surgical interference with established infection, clinical evidence as to the predominance of anerobic or aerobic infection forms a most useful guide. In the former case delay may be fatal to life or limb; in the latter an interval of rest often results in a rapid subsidence of local signs and general symptoms, and no further incision may be required.

There is a discussion and comparison of the Bipp and Carrel-Dakin methods of treatment.

Secondary hemorrhage.—The eventual perforation of a vessel wall is up to a certain date, more commonly the result of the separation of a slough of primarily devitalized tissue, rather than the extension of a process of infective ulceration from without.

8. Morison, R. The Treatment of Infected, Especially War, Wounds. *Brit. Med. Jour.*, October 20, 1917, p. 503.

Summary of technique.—1. Under an anesthetic, usually open ether, cover the wound with gauze wrung out of 1 to 20 carbolic acid, and clean the skin and surrounding area with the same lotion.

2. Open the wound freely and, if possible, sufficiently to permit inspection of its cavity. A guide—a finger is the best if the size of the wound permits of it and, if not, a thick probe—should be introduced to the bottom of the wound and held there and fully exposed. In doing this special regard should be paid to nerve trunks and muscular branches of nerves, since the division of blood vessels, excepting the largest, and of muscles themselves does little harm as compared with that of the disability following nerve damage. Cleanse the cavity with dry sterile gauze mops, Volkman's spoon, etc., and remove all foreign bodies.

3. Mop the surrounding skin and wound cavity with methylated spirit and dry it.

4. Fill up the whole wound with Bipp, rub it well in with dry gauze. Then remove all excess, leaving only a thin covering over the wounded surface. Dress the wound with sterile gauze and cover all with an absorbent pad, which is held in position with sticking plaster and a bandage. This dressing requires no change for days or weeks if the patient is free from pain and constitutional disturbance. Should, however, discharge come through, the stained part must be soaked in spirit and a gauze dressing wrung out of the same applied as a further covering.

Redressing is very simply done. After removal of the old dressings the wound

is covered with a dossil of wool soaked in spirit, and the sticky, dirty-looking discharge is wiped off the surrounding skin until it is clean.

One drawback to the method is the risk of iodoform or bismuth poisoning due to applying the paste too freely. Another drawback is that as iodoform and bismuth are both opaque to X-rays, there may be difficulty in the discovery of foreign bodies and unsatisfactory pictures of fractures, taken after the paste has been applied.

The author claims that by this method compound fractures of all the bones can now be treated with as great ease, both to the patient and the surgeon, as simple fractures are.

With very few exceptions, fresh wounds can be closed without tube or other drainage than is allowed for, between interrupted sutures not placed too close together.

Preparation, sterilization and keeping of Bipp: Iodoform, 440 grams; bismuth subnitrate, 220 grams; paraffin, 220 grams.

The bismuth and paraffin are sterilized by dry heat at a temperature of 120° C. for half an hour, the bismuth after cooling is mixed with the iodoform in a mortar which has been sterilized by means of boiling water and formalin. The paraffin is added to the mixture at a temperature of 90° C. and thoroughly mixed, then put into specially made collapsible tubes with nozzle ends, holding 40 to 80 grams. The paraffin used should be semi-solid, odorless and tasteless, melting point 45° C., free from acidity and carbonizable organic impurities. The iodoform should be free from moisture, acids and fixed impurities. The bismuth must be pure and free from arsenic.

FACIAL PARALYSIS

1. Morestin, H. Treatment of Facial Paralysis Due to Gunshot Injury, by Muscular Anastomosis. *Bull. et. mem. Soc. Chir. de Paris,* 1916, p. 370.

The patient was wounded by a rifle bullet which entered the upper part of the neck a little below the mastoid process on the right side, crossed the parotid region from behind forward and from without inward, sectioning the trunk of the facial nerve at its exit from the petrous bone, passed inside the ascending ramus of the inferior maxilla, perforated the buccal mucosa in front of the anterior pillar of the fauces, crossed the palatine vault obliquely, then perforated the latter, passed through the palatal process of the left superior maxilla and the corresponding maxillary sinus, with wound of exit in the infraorbital region of the left side.

When seen five months later the patient was seen to have a total paralysis of the right side of the face. The right lingual nerve had also been cut as evidenced by complete anesthesia and abolition of taste sensation of the right half of the tongue in its anterior part. There was, besides, complete anesthesia of the infraorbital distribution of the left side, owing to severing of this nerve at its emergence from the maxillary sinus.

BOOK REVIEWS

The Modern Gasoline Automobile, Its Design, Construction, Operation and Maintenance, by Victor W. Pagé, M.E. New York City: The Norman W. Henley Publishing Company. Price, $3.

Victor Pagé's treatise on the gas motor car comes to us, in the words of the publishers, revised, enlarged, reset and showing all recent improvements; which certainly appears to be the case.

A so thoroughly recognized standard work, in many editions, would need but mention to demand the attention of all interested in automobiles (who is not!), and an extended review would ordinarily serve no purpose more. But, in this stage of the game, the gas engine has become, to the military medical officer, something more than a means of transport or pleasure; it is an instrument of war and a surgical appliance.

This text-book should therefore be made a factor in the curriculum of our training schools, not only for the instruction of the officers, but of all the men of the sanitary troops; for it is quite desirable, indeed necessary, that all should have an intelligent comprehension of the gasoline automobile, what and why it is, and what it can do, for upon this knowledge will, in no small degree, depend the lives and limbs of our soldiers.

Self-instruction in Elementary Military Map Reading and Topographic Sketching, by Maj. Gustavus M. Blech, M. C. N. G., U. S. Army. Houston, Texas: Standard Printing and Lithographing Company, 1917.

The author first points out the essential differences between the geography map with which every schoolboy is familiar and a map suitable for military purposes, then in proper sequence explains the use of scales, compass, protractor and clinometer, with practical hints as to improvising, and their application to the construction of contours and other details of military map-making. The explanations, together with the illustrations, make the subject so clear that the beginner will be able with a little practice to make a good road sketch and a fair map of a limited terrain. In short, this little book of handy pocket size is indeed a "Self-instructor" which a beginner in the study of military map-making may benefit by. George Andrews.

The Principles and Practice of Dermatology, by William Allen Pusey, A.M., M.D. Third edition; complete revision; illustrated by 54 plates and 466 text illustrations. New York and London: D. Appleton and Company, 1917.

This excellent treatise gives a complete, up-to-date exposition of modern dermatology. To one experienced in dermatology, it is a pleasure to read the text and to study the pictures. It will undoubtedly prove of the greatest assistance to students and general practitioners.

The book is well arranged, the chapters are well adapted, and the headings, sub-headings and paragraphing are most wisely and clearly set off. The ready reading and clear-cut description throughout the text are most gratifying and assuring when one seeks for definite information. Concise statements and well-formed opinions and judgments are everywhere to be found.

The most outstanding feature throughout is the wealth of most excellent pictures, which accompany the description of practically every disease or condition and are an education in themselves. These pictures are of the black and white type, undoubtedly true to life, and depict, in an exceptional manner, the lesions and characteristic manifestations of the subject. These pictures, practically all of which are actual photographs, give the impression of being well selected and chosen, because they most clearly show those points to be brought to the eye by the clinical picture. Each picture has that distinct value rarely to be found in medical text-books, and such a feature should commend a book on dermatology, in which pictures to illuminate the wordy description are of inestimable assistance and afford the possibility of a more clear-cut conception on the part of the reader of many conditions which are either difficult to recognize, or are so similar in appearance, as to be indistinguishable by one who lacks much clinical experience.

The brevity, yet comprehensiveness, of Part I on anatomy, physiology, pathology, etc., lends to an understanding of that part of this specialty, often a bugbear or commanding little interest on the part of the student.

Twenty-one new conditions, changes of the blood in skin diseases—a feature long neglected—auto-serum therapy, and fulguration compose, in part, the new matter in the book.

The chapter on syphilis presents a most comprehensive exposition of the disease and its treatment, so far as dermatology is concerned, including sections upon the administration of salvarsan and neosalvarsan; in fact, nothing has been neglected to make the information complete.

Eczema is discussed in its modern conception as a dermatitis, varying according to circumstances and the productive agent. This is a distinct advance.

Treatment is discussed on rational lines and sufficient information is given to enable one to carry out suitable attempts at cure. Prescriptions of a sensible, desirable sort are numerous throughout the discussion of applications.

A most complete bibliography follows the description of each disease.

W. E. Eaton.

Technic of the Irrigation Treatment of Wounds by the Carrel Method, by J. Dumas and Anne Carrel. Authorized translation by Adrian V. S. Lambert, M.D., Acting Professor of Surgery in the College of Physicians and Surgeons (Columbia University), New York. With an Introduction by W. W. Keen, M.D., LL.D., F.R.C.S. (Hon.). New York: Paul B. Hoeber. Price, $1.25.

The details of Dr. Carrel's method of treating war wounds by Dakin's solution are amplified in this little brochure by his colleague, M. le Dr. J. Dumas, and the former's devoted and talented wife. It was written primarily for the information of nurses so that they might have a clear, short account of the various details of the technic, and an accurate description of the apparatus used in carrying it out. The book is not intended to supplant the more complete account written by Dr. Carrel, "The Treatment of Infected Wounds," recently reviewed in The Military Surgeon. It is simple and direct and will serve as a guide for those wishing to become proficient as-

sistants. It is shorn of all theoretical considerations which might be confusing or be a subject of controversy. FRANCIS M. MUNSON.

A COMPEND ON BACTERIOLOGY, INCLUDING PATHOGENIC PROTOZOA, by Robert L. Pitfield, M.D., Pathologist to the Germantown Hospital, etc. Third edition. Blakiston, Quiz-Compends. Philadelphia: P. Blakiston's Son & Company Price, $1.25.

This is a new and up-to-date edition of a little book designed to serve the needs of the medical student preparing for examination and for the busy practitioner who desires to acquaint himself with the principal facts of the rapidly growing science of bacteriology. A successful effort has been made to reduce the subject matter to as concrete a form as possible. The book gives an outline of the essential accepted teachings on the subject.

Within its limits it will serve the purpose for which it is written.

FRANCIS M. MUNSON.

"NEUROSYPHILIS," by E. E. Southard, M.D., Sc.D., Bullard Professor of Neuropathology, Harvard Medical School; Pathologist, Massachusetts Commission on Mental Diseases; Director, Psychopathic Department, Boston State Hospital; Vice-President American Medicao-Psychological Association, and H. C. Solomon, M.D., Instructor in Neuropathology and in Psychiatry, Harvard Medical School; Special Investigator in Brain Syphilis, Massachusetts Commission on Mental Diseases; Acting Chief of Staff, Psychopathic Department, Boston State Hospital. With an introduction by James Jackson Putnam, M.D., Professor Emeritus of Diseases of the Nervous System, Harvard Medical School. Octavo, 496 pages, well illustrated. Boston, Mass.: W. M. Leonard, 1917.

To those who have followed the writings of these two authors for the past few years, this well-prepared volume comes as no surprise. It might aptly be described as a series of excellent clinics on nervous syphilis, including quite a satisfactory assortment of other diseases, the diagnosis of which is liable to be confused with that of syphilis. One section is devoted to "Puzzles and Errors in the Diagnosis of Neurosyphilis (including Non-syphilitic Cases)." This section is specially refreshing in view of the present rather extreme tendency to diagnose conditions as syphilitic on what would be inadequate grounds if some other disease were under consideration. The authors develop the value of careful clinical study of cases as well as post-mortem pathology in confirming or disproving diagnoses, this in contradistinction to the slipshod method of basing a diagnosis entirely upon the Wassermann reaction and often a single one at that. In obscure cases, they require three negative Wassermann reactions before accepting a negative diagnosis. Their brief remarks upon the treatment of syphilis (pp. 142 and 145) should be read by every physician who is brought into contact with this disease.

The authors draw attention to the lack of significance of the spinal fluid cell count taken as a single factor, as well as to the presence of a characteristic gold sol curve in multiple sclerosis without syphilis. It is unfortunate that, in the various case discussions, the results of the gold sol reactions have not been given in figures. A chapter on "Neurosyphilis and the War" is quite apropos. The illustrations are numerous and well chosen. M. A. REASONER.

THE THIRD GREAT PLAGUE, a Discussion of Syphilis for Everyday People, by John H. Stokes, A.B., M.D., Chief of the Section of Dermatology and Syphilology, The Mayo Clinic, Rochester, Minn. 12 mo, 204 pages, illustrated. Philadelphia and London: W. B. Saunders Company, 1917. Cloth, $1.50 net.

The recent spread of information to the laity upon the subject of venereal diseases and the general interest aroused upon this formerly tabooed subject have brought forth a number of books intended to fill this want. It is a difficult matter to properly write such a book so as to give the right amount of information and in the proper manner. It is a pleasure to state that Dr. Stokes has handled his subject most satisfactorily. He has with great skill sailed between the Scylla of brevity and the Charybdis of profundity. This book should appeal to the general practitioner and syphilographer as well as to the laity, because it says so well the things we are often called upon for information. The chapters upon the transmission and hygiene of syphilis, the mental attitude in syphilis, and his résumé of the public activities against syphilis are well worked up. The last mentioned chapter in particular will be of value as a source of reference.

With proper safeguards, this publication can with safety be passed into the hands of the intelligent laity and, in selected cases, an undoubted benefit would be obtained by placing it at the disposal of certain unfortunates who have contracted this disease. M. A. REASONER.

DIAGNOSIS FROM OCULAR SYMPTOMS, by M. L. Foster, M.D., F.A.C.S. New York: Rebman Company, 1917.

In reviewing this excellent work one feels the first part is rather primary to an ophthalmologist, and wonders if it is meant for the specialist or the general profession.

The remarks on ptosis are good and cover this elusive subject very well. The nomenclature on the brain might be brought up to date. The discussion of the lid conditions is excellent; practical, concise, and accurate. The section on displacements of the eye-ball suggests much; it might perhaps be more extended but there must be a limit somewhere, and this has been wisely observed. A bibliography would have greatly enhanced the value of the work.

The observations on conjugate deviation are not clear while those on the conjunctiva are excellent. The most important diagnostic points on this difficult branch of ophthalmology are clearly brought out, and in particular is this so regarding the differential diagnosis of vernal catarrah and trachoma. It presupposes very clearly, however, in this part of the work, that the student has an advanced knowledge of ophthalmology. Folliculosis and follicular conjunctivitis is an excellent clinical division and one of practical value.

The conception of tuberculosis of the conjunctiva is good, that of interstitial keratitis the clearest that could be imagined, but that of ulcer of the cornea is meager.

It is advised that a tenometer should not be used in plastic iritis, its use simply impressing the patient, as would a theatrical performance. This point

is not at all well taken. If we need the information as to the tension of the eye nothing short of actual damage to that organ should deter one from making this important examination.

The remarks on iritis are excellent, the differential diagnosis in particular, while those on cataract, glaucoma, and sympathetic inflammation are concise, and not too qualified and voluminous, as accounts of these conditions are apt to be.

The section devoted to spots on the fundus are not satisfying, but those sections devoted to tumor of the fundus, glioma, pseudo glioma, and tuberculoma, together with detached retina, are very good indeed.

The discussion of hemianopsia is practical and valuable more particularly for the reason that it does not undertake extended discussion of the condition, bearing in mind, no doubt, that the student can go to the works on neurology for this.

The author states it can scarcely be likely that neuralgia (trigeminal) can come from eye strain. It is most assuredly one of the many etiological factors of this condition. The remarks on our shortcomings in refraction work are refreshingly frank; the dissertation on eye strain is full of good common sense spiced with accurate scientific knowledge and practical experience.

Withal, it is a most readable book, one that we may peruse with pleasure and profit.

WM. T. DAVIS.

INTERNATIONAL CLINICS, a Quarterly of Illustrated Clinical Lectures and Especially Prepared Original Articles on Treatment, Medicine, Surgery, Neurology, Baediatrics, Obstetrics, Gynecology, Orthopedics, Pathology, Dermatology, Ophthalmology, Otology, Rhinology, Laryngology, Hygiene, and other topics of interest to Students and Practitioners, by Leading Members of the Medical Profession throughout the World. Vol. iii, Twenty-seventh Series, 1917. Philadelphia and London: J. B. Lippincott Company.

A medical book issued as a series, that can continue in existence and popularity well into the twenty-seventh series, must have had, and hold, an enviable position in current medical literature. The latest contribution, Volume iii, explains the popularity of the publication. First, there is a series of clinics by men of recognized ability, the subjects presented covering a wide field of general medicine and surgery, including an up-to-date article upon the part that focal infections may play. There is a good article upon the clinical value of arterial blood pressure, as well as several others upon topics of special interest, including "Notes on Tetanus in the War of 1914" and another, "Neurasthenia before and after the War." Under the heading *Surgery* are to be found several articles of special value, more particularly one by Wayne Babcock on "Experiences in Reconstructive Surgery of the Extremities," one of the very best papers on this topic that has appeared in any publication. For the general practitioner as well as for the specialist who wants to keep informed of the science and art of medicine from the clinical side, the *International Clinics* unquestionably has a valuable place.

JNO. E. SUMMERS.

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THE MILITARY SURGEON

VOL. XLII APRIL, 1918 NUMBER 4

ORIGINAL ARTICLES

Authors alone are responsible for the opinions expressed in their contributions

MANIFEST PULMONARY TUBERCULOSIS

BY COLONEL G. E. BUSHNELL, M. C., U. S. A. (Ret'd)

(With twelve illustrations)

WHILE numerous articles in the medical press are devoted to methods of detecting incipient tuberculosis, the study of the more advanced forms of pulmonary tuberculosis is, in comparison, much neglected. The text-books, with their numerous subdivisions and wealth of detail, are confusing to the beginner, who is apt to feel at a loss when confronted by the varied signs of large tuberculous lesions. Yet the importance of skill in diagnosis of age and kind of lesions present in a given case is great for all who have to do with tuberculosis cases, for upon such diagnosis depends the prognosis. Prognosis is the first and last thing demanded of the physician by the patient's friends, and upon the prognosis which he gives he is judged. In military medicine a correct diagnosis and prognosis is perhaps peculiarly desirable, because the conditions of military service frequently make necessary the transportation of tuberculous patients, sometimes over great distances. It is important, for reasons of humanity and for the credit of the medical officer and of the service, that he distinguish transportable from non-transportable cases. Too often it seems to be considered that, a case once labeled as tuberculous, all of the usual contraindications as to travel are removed and that a moribund patient may properly be sent on long journeys to seek, forsooth, the advantages of a change of climate. Medical officers should be held strictly responsible for the exercise of an enlightened judgment as to cases which may or may not be evacuated from their hospitals, not only as respects the obvious indication that dying men should be allowed to pass their last days in peace, but also the retention for proper periods of patients with exacerbations or with history of recent hemoptysis. In view of the above considerations it has seemed to the writer expedient to

attempt a brief discussion of some of the salient points in the diagnosis of the manifest pulmonary lesion, with a view to indicate simple methods of reaching an approximate diagnosis and prognosis of the disease. The effort has been made to simplify the subject by the omission of all but the most important points, in the hope of furnishing clues for threading the maze of signs and symptoms of the advanced cases. As in all attempts at simplification, the danger is run of omitting too much—of making unguarded statements which may be all too successfully attacked. It seems best, however, to run this risk rather than to incur the other risk of confusing the presentation of the subject, by guarding the statements made so carefully that the rules involved are lost sight of in the exceptions. No one can be more conscious than the writer of the difficulties of such an undertaking, and he offers this contribution in the hope that its shortcomings will be viewed with charity.

In order to assist the inexperienced, after a discussion of the various types of the disease, paragraphs have been added which indicate by questions the points which should be borne especially in mind in the study of the tuberculous lesion.

FIBROSIS.

When tuberculous infection first takes place the cells of the body begin to receive a pabulum through the blood which is changed in quality; it has a tuberculous taint; the products of the tubercle bacillus and the albuminous constituents of the blood which have come in contact with these products and have been changed thereby afford a new nutritive problem for the tissue cells. They must hereafter obtain their nutrition from materials of an altered quality—they must learn to digest tuberculized albumen. Hence a change must take place in the nature of the ferments which are to convert the nutritive substances furnished by the blood into other substances adapted for the special needs of the cells in question. This change in the functional activities of the cells begins at once. Grüner and Hamburger think that a change in the reactivity of the body can be demonstrated to occur within six days after infection, but the initial changes are only a beginning. The process requires at least three months before it can be said to furnish a good measure of protection, and years elapse before the body has attained the power to digest tuberculized albumen or, if you please, to furnish tuberculocidal or bacteriocidal ferments, to the fullest extent of which it is capable. Immunity, then, shows itself in the ability to furnish ferments capable of attacking the tubercle bacillus and its products.

Looking at the process from another standpoint, we may say that immunity manifests itself in the ability of the cells to maintain their existence and to proliferate in the presence of the poisons of the tubercle bacillus. The well-nourished, vigorous cells will naturally gain such power more quickly and to a greater extent than those less healthy. The stronger and better nourished the individual, the greater his chance to acquire a durable immunity provided that the initial dose of poison has not been too large. Excessive doses of toxic substances or defective nutrition of the cell defeat the effort to acquire resistance. If the two unfavorable factors are combined, the result of the infection is disaster, immunity is not acquired, and the initial tuberculosis leads speedily to death. We may judge, then, of the degree of immunity by the success with which tuberculous lesions are isolated through the formation of a capsule of connective tissue which prevents their further growth. One disadvantage is, however, apparent in this isolating process, which is that the poisons of the focus are accumulated instead of being dispersed. A point may be reached beyond which the concentration of the poisons of the focus cannot be endured by the most vigorous cell, the cells die, small foci coalesce into a single large focus, and a cavity may result. Even yet there is an opportunity for the defense to rally, the cavity becomes surrounded by a thick wall of fibrous tissue, the more readily because the caseous tissue has dropped out and no longer poisons its environment, and the former lesion may first be discovered at autopsy after many years of immunity to tuberculous infection.

This is the explanation of the hard saying that cavitation is a sign of immunity—immunity shows itself by the isolation of the focus even though such isolation leads to the death of the cells most closely involved. We see, then, in the most chronic cases, few and large foci sharply circumscribed and isolated, instead of the many and smaller foci surrounded by little or no new-formed connective tissue which characterize cases of less resistance. The process of isolation of the tuberculous focus being favored by relative rest of the part, large foci or cavities are typical of lesions of the upper part of the upper lobe, and are succeeded by smaller lesions as the disease progresses downward to parts of greater motion. Though the initial efforts to resist the spread of the disease may fail, the cells of the resistant organism still retain the power to proliferate in the presence of the toxic substances of the tuberculosis, the result of which, continued during many years, is the formation of great beams of connective tissue about the upper lesions. By the time

that death finally ends the long struggle, the upper lobe, even the entire lung, may have become converted into a fibrous sponge, contracted sometimes by the drawing together of the fibrous threads into a small gristly mass of bronchi blood vessels and fibrous trabeculae which bears little resemblance to the normal lung either in size or in structure.

From the foregoing we draw two conclusions: first, the presence of abundant fibrous tissue is a sign of an old lesion; second, it is also a sign of relatively high immunity. From the physical properties of fibrous tissue, its relative non-vascularity, its contractility, and from its density as compared with normal pulmonary tissue we would expect that the lesion would be dry, that the tissues would be indurated, and that breath sounds would be conducted with increased distinctness. Fibrous lesions are in fact characterized by diminution or absence of râles, by well-marked dulness on percussion, by distinctness of transmission of the voice and, above all, by a sharpened inspiration and a prolonged as well as sharpened expiration.

The defense exerted by fibroid encapsulation is often loosely spoken of as an absolute mechanical defense, as if the wall of fibrous tissue were really impenetrable for the tubercle bacilli. That this is not true is shown by facts such as the following: first, in well-marked cachexiae, as of cancer, reactivation of ancient tuberculous foci sometimes occurs; minute invasions of new-formed tubercles are found on close examination to have proceeded from hard contracted fibrous glands at the hilus or elsewhere in the deep lung, without evidence of active tuberculosis in other parts of the body; second, at autopsy we often find evidences of the invasion of fibrous structures by tubercles as part of the miliary extensions characteristic of the pre-agonal stage of the disease, perhaps as a row of minute tubercles like a string of pearls, threaded through the midst of a massive beam of fibrous tissue. The connective tissue wall is a protection, but not an absolute one, against further dissemination. Only the ferments produced by the immune cell can truly inhibit the growth and extension of the tubercle bacilli. Fibrous tissue thus invaded is no longer a dry tissue. But, with this exception, it is correct to say that in general the fibrous lesion is a dry lesion.

CASEATION

The effect of the presence of caseous foci is to produce a wet lesion. As will be understood from the foregoing, a caseous mass, even if surrounded by dense fibrous tissue, may still soften and

liquefy. We may have numerous caseous areas embedded in connective tissue, some of which are dry and apparently stationary, while others are in the process of breaking down. In general, however, the presence of numerous caseated areas discourages the formation of fibrous tissue. Where fibrosis predominates, the lesion is called fibrocaseous. Where tubercle is abundant, it is called caseofibrous. Thus, it will be seen, the presence or absence of moisture determines in a rough way the amount of caseous tissue present, the absence of moisture usually establishing the fact that there are at least no softening tubercle connected as open lesions with the air tubes of the part, while the presence of abundant moisture leads us to conclude with some degree of probability that the reverse is true.

BREATH SOUNDS

The bronchovesicular breathing in the chronic case may be said to be a sign of the presence of fibrous induration. It is also characteristic of the dry lesion. Dryness greatly favors the conduction of the bronchial sounds to the periphery. A wet tube may give not bronchovesicular[1] but rough breathing, or the breath sounds, at least in feeble or moderate respiration, may be indistinguishable from the normal, even though considerable induration be present in a fibrocaseous lesion. In massive caseation the tissues have lost their elasticity and, in so far as they are caseated, do not expand at all in inspiration. (Plate VII.) Ordinary breath sounds are absent in such cases or are present enfeebled in less complete caseations. Ordinarily what is heard is a weak and distant bronchial breathing, conducted from the deep bronchi and mingled with the coarse râles characteristic of these tubes.

The observer should, therefore, be on his guard not to draw necessarily a favorable conclusion from the absence of small or medium-sized râles when the patient's condition is bad. In gangrene, breath sounds are lost over the affected area. The same is true of plugging of the bronchi which may be temporary or permanent, the result in the latter case being ultimately caseation as a rule.

RÂLES

Râles are divided into typical pneumonic râles, the crepitant and subcrepitant, and indeterminate râles, the latter including all râles not characteristic of acute pneumonic inflammation. Indeterminate

[1]For the sake of brevity the term "bronchovesicular" is used to designate a change in breath sounds which consists in increased harshness or "sharpness" of inspiration and expiration, with prolongation of the latter.

râles may profitably be subdivided into typical and atypical râles. The typical indeterminate râle is moist, viscid, small or medium in size (but always larger than the true subcrepitant râle), is heard during inspiration, bursts near the ear, and may occur in showers. It is formed in small bronchi, plentifully supplied with exudate as the result of inflammatory reaction to neighboring tubercle. Its presence is therefore a sign on the one hand of the existence of an active superficial tuberculous lesion, and on the other hand of the fact that there is no massive caseation, the tubercles are still discrete, and the process, therefore, either recent or of only moderate acuity. As the crepitant and subcrepitant râles are signs of acute inflammatory reaction, so the typical, indeterminate râle is a sign of chronic inflammatory reaction; and, further, just as crepitant and subcrepitant râles disappear when exudate fills the alveoli, so does the small, moist, indeterminate râle disappear when bronchi become occluded or extensive caseation has developed.

The disappearance of small, moist râles in a given region of the lung with advanced lesions is therefore of as much significance as their presence. Localized persistent and numerous typical indeterminate râles constitute the best evidence of the existence of chronic inflammation in lesions containing discrete tubercles and furnish a means of determining the location of deposition of tubercle in fibrocaseous lesions. The atypical indeterminate râle is found in tubes which contain varying and usually relatively small amounts of fluid. Hence they have no fixed characteristics as respects size and time of occurrence in respiration. As a rule, in tuberculosis the atypical indeterminate râle is the râle of the large bronchi, but they are found towards the close of the early stage of miliary tuberculosis and in deep peribronchial tuberculosis. When they are disseminated over the entire lung, they are usually a sign of non-tuberculous disease—heart disease, pulmonary edema, asthma, bronchitis or pulmonary excretion ("gouty bronchitis").

In examining a large lesion it should be remembered that, except in the most acute forms, it is altogether probable that the greater part of the lesion will not be undergoing a typical inflammation at the time of examination. The problem will be to determine the regions where there is true activity and to distinguish them from other regions in which the process has burnt itself out, where, perhaps, râles come from small cavities interspersed in massive fibrous tissue or where fibrous tissue alone remains and transmits occasional râles from the bronchi beneath it. To accomplish this it is necessary to study carefully the characteristics of the various râles

which may be heard. Râles bear no necessary relation to sputum: indeed sputum is not a necessary concomitant of the tuberculous process—rather is it a complication, the evidence of irritation of neighboring bronchi. In some cases of extensive and active tuberculous disease there is practically no expectoration.

The degree of viscidity of the bronchial moisture is an important datum in the study of the chronic lesion. In fibrosis there is usually an old circumscribed lesion of the upper parts of the lung, a cavity or at least dilated or otherwise damaged tubes from which exudes more or less mucus, mingled usually with pus. Hence cough and expectoration are present as a rule in cases of fibrosis. When the fibrosis is the preponderating condition, the râles will be confined to the larger tubes and the mucus will be viscid and raised with difficulty, except so far as it may be diluted with the pus from pyogenic membranes. The coarseness of the râles reveals their origin. If small or medium râles are detected, the lesion probably contains softening tubercle and the prognosis as to prolongation of life is less good. The degree of viscidity and the abundance of the râles give some idea as to the relative acuity of the process, which is the more acute the less viscid within limits and the more numerous the râles. Least viscid of all the râles is the so-called serous râle. These are heard rarely in the chronic lesion under conditions which are little understood. The effect is as if the lesion had been flooded with a non-viscid fluid through which air bubbles. The râles are very numerous, burst without the characteristic delay of the mucous râle, as if, in other words, the rupture of the bubble were not attended by resistance, and have a peculiar, soft, breezy quality which cannot be described. This phenomenon is generally evanescent and is not inconsistent with a considerable prolongation of life.

Râles constitute the auscultatory evidence of inflammatory reaction to the poisons of tubercle. They are the best evidence that the lesion is resisting its foes. Râles are absent in the obsolete or arrested lesion—the body does not need to fight. They are present in the stage of reaction—the body is fighting—whether successfully or not is to be determined in part by the number and quality of the râles, in part by other considerations which will be taken up in the following section. They may be absent again when the body can no longer fight—when the power to react has been lost. Nothing could be more erroneous than to draw favorable conclusions from the diminution or the disappearance of râles in the very advanced case.

SYMPTOMS

As has been stated, the number and degree of viscidity of the râles justify conclusions as to the acuteness of the tuberculous process, many râles of slight viscidity denoting a process which is not progressing favorably, in which the lesions are breaking down with more or less rapidity. But conditions may be equally or more unfavorable when râles have become more viscid and scanty or finally disappear entirely. For the determination of such a case recourse must be had to the symptoms—it is very important to determine whether the disappearance of râles is a sign of good or evil omen. If the patient is gaining weight, if he feels stronger, if fever is abating or absent, if expectoration of mucopus from cavities is lessening, the sign is a favorable one. If, on the other hand, the patient continues to lose weight, if cough and expectoration do not diminish, if fever continues and especially if it becomes more persistent and the patient's strength grows less, the absence of râles is to be interpreted as evidence that the reactive powers are beginning to wane. The condition is naturally only finally determined after continued observation.

TOPICAL DIAGNOSIS

We cannot get a correct idea of the tuberculosis of the civilized man unless we think of it as a process which develops in the partially immune subject. Immunity against tuberculosis is produced successfully in the majority of the members of civilized races, so successfully that in fully 70 per cent the disease is never recognized clinically, and in the remaining 30 per cent almost all the cases of the manifest disease present themselves under a form very different from that which characterizes truly primary tuberculosis. Manifest tuberculosis is due to a temporary or permanent, complete or partial loss of immunity. The forms in which it appears differ according to the degree of immunity which has been present, but usually there is evidence of a considerable resistance during the early phases of the disease. In the highly immune the manifestations of tuberculosis are the less apparent the more perfect the immunity; hence the failure to recognize the fact that tuberculosis is or has been present at all. However, the X-ray and the comparatively coarse tuberculin test, both subcutaneous and by the von Pirquet method, give positive results so frequently that the most reasonable hypothesis is that the immunity of the untested or negatively reacting minority is also due to tuberculous infection.

NORMAL APEX

Breath sounds and percussion-note normal for location. Krönig's isthmus broad and equal on both sides. Apices resonant on Goldscheider percussion. Observation excludes well-marked chronic disease of upper part of upper lobe. *Does not exclude acute forms.* Examine for râles on ordinary breathing and with expiration and cough, above and below clavicle on both sides.

APICAL TUBERCULOSIS

Observation shows that in the more resistant cases the first manifestation is in the apex. In the best cases the X-ray shows a single thickened line extending nearly vertically from the hilus, which ends in a network as the surface of the lung is approached, the lines of the network terminate at the pleural surface, as it were a stream which branches into a delta near its mouth. When the resistance has been less the lines from the hilus become multiple, the superficial network thicker and more complex, containing one or more discrete fibrous or calcified tubercles. A lesion of this degree is rarely recognized during its activity. It results in contraction of the apex shown by a narrowing of Krönig's isthmus, an induration recognizable by accurate percussion, and by a slight change of breath sounds toward the bronchovesicular quality. Progressively less resistant are the forms in which the initial foci coalesce into one or more large foci, which may become encapsulated or may lead to cavity. Usually by this time the process is no longer confined to the true apex and is more properly denominated tuberculosis of the upper lobe. Whereas the first forms described are wholly benign and are not usually recognized as tuberculosis until light is thrown upon them by the X-ray, the latter forms are accessible to physical diagnosis and should be recognized by dulness, and by bronchovesicular breathing with or without râles.

Apical lesions in the strict sense are of importance in diagnosis only as respects the decision as to whether a lesion is present at all. It is quite exceptional that a lesion in its acute stage is found in the apex which does not extend below the clavicle, though the possibility is of course admitted. The apical lesion being in continuity with the extension from the hilus, and being situated in lung which has little or no motion, is aborted in cases with reasonably good immunity. It then presents itself to the observer with the signs of a fibrous lesion. This fibrous lesion is often mistaken for a non-tuberculous collapse, or not detected at all. The non-tuberculous collapse, being a simple atelectasis, is characterized by an enfeeble-

ment or loss of breath sounds; the air does not pass freely into the lung, whereas in the fibrous lesion breathing is free and loud. The breath in both lesions may have the bronchovesicular quality, but this is more marked and louder in the fibrous lesion. From the fact that the apical lesion is usually found in an arrested state, it is often not recognized, and the later extensions lower down in the upper lobe are taken to be the first of the superficial lesions. The doctrine is held by many that the earliest incidence of tuberculosis is at a point lower down in the upper lobe than the apex, or is even at the upper edge of the lower lobe. The X-ray shows, however, that in the great majority of cases the apex is first of superficial parts to be invaded.

UPPER LOBE LESIONS

Often the tuberculous lesion of the upper lobe has consisted in the deposition of a few tubercles which remain discrete, become fibrous or calcified or, if small, disappear entirely, and the existence of a lesion is to be determined solely by the signs which point to diffuse thickening of the connective tissue framework. If pneumonia occurs, the period of pneumonic inflammation being a self-limited one, the probability is great that lesions of the upper lobe will be first detected when they have reached a stage of chronic inflammation or of the induration or caseation which marks the terminal stage of the local process. As a matter of fact, it is quite rare that true subcrepitant or crepitant râles are found in this region. The lesion as it usually presents itself is a chronic lesion, characterized by a harsh inspiration and harsh and prolonged expiration, with or without indeterminate râles according to the activity of the process. Not rarely a well-marked lesion of the upper lobe is seen, which has run its course and becomes arrested without the knowledge of the patient and without detection by his physicians, in some cases notwithstanding numerous examinations. The writer recalls a clergyman coming for examination on account of hemoptysis, who had a typical paralytic thorax and extreme gastroptosis, who stated that because his appearance led to the suspicion of tuberculosis he had been frequently examined for that disease, in the large eastern city in which he dwelt, but always with negative results. Notwithstanding this history there was a well-marked and good-sized lesion of the right upper lobe which was shown with great distinctness as an old and arrested condition by the X-ray. The history pointed back with clearness twenty years to the inception of the disease as a manifest process.

Less chronic and less indurated small lesions of the upper lobe are detected with greater difficulty. Percussion gives slight dullness on the affected side, with usually some increase in vocal resonance; the breath sounds are of the bronchovesicular type, but not necessarily markedly so. The measure of the degree of induration and contraction is sometimes better afforded by the narrowing or disappearance of Krönig's isthmus than by the classical signs over the lesion itself, which are often rendered indistinct by a compensatory emphysema of the neighboring lung.

The presence of an old lesion may only be shown by bronchvesicular breathing and a slight shortness or raised pitch of the percussion note, as shown by careful comparison with the other side. (Bronchovesicular breathing in the second interspace, right side near sternum, diminishing rapidly outward and downward, is normal. If the signs extend outward in the second and third interspace for more than a short distance, there is a lesion.) But it does not follow that a lesion of this kind is of clinical importance. There is as much difference in the severity of even arrested lesions as exists between a scorch of the skin and a burn of the third degree. It is one of the remarkable facts in physical diagnosis that slight changes in the fibrous framework, if they extend to the surface, so slight as ordinarily to escape notice at autopsy, may be detected by auscultation and percussion.

In one case the X-ray shows a single line from the hilus, ending near the surface of the apex in small branches, the lesion dating back to a hemorrhage thirty-eight years ago without evidence of any signs or symptoms since that time. Several experts have independently determined the existence of an old lesion by physical diagnosis. The importance given to the determination of such obscure lesions rests upon the erroneous assumption that harshness of breathing and prolongation of expiration constitute signs of an incipient lesion. As has been said elsewhere, if the increased transmission of sounds from the bronchi is due to inflammatory engorgement, there is a frank lesion; usually these signs show a chronic condition. In estimating prognosis we should consider the intensity of the now obselete process as carefully as its extent. There is a wide range from the lesion in which the pleura is glued fast to the ribs, breathing is harsh, dullness is marked, X-ray shows many strongly marked lines and one like that referred to above. The first type has some clinical importance; the second is to be neglected. It is therefore incorrect to fill wards with so-called suspicious cases in which the determination of the diagnosis is delayed from doubt as to the sig-

nificance or importance of obscure signs, there being no reason why the diagnosis cannot be made at once. It is true, of course, that the possibility of a dissemination of tubercle, which has not yet given signs of its presence, introduces an element of uncertainty in *all* diagnosis, but the chance of such a dissemination in an obsolete lesion is much less than in a healthy part of the lung. It is only justifiable to suspend the rendering of a diagnosis in cases in which the patient is much more ill than can be accounted for by the visible disease.

THE LARGE SUPERFICIAL LESION

Typically this lesion is made up of a cavity surrounded by abundant fibrous tissue above, below this a few large isolated tubercles, and still farther down numerous small tubercles. (Plate II.) We find above well-marked dullness on percussion, cavernous breathing or very harsh bronchovesicular breathing, increased vocal fremitus and resonance with pectoriloquy over the cavity. Proceeding downward, an area is reached over which râles are finer, less viscid, and more abundant. Dullness may be present, but to a less marked degree, and voice sounds are less clearly transmitted. Still farther down the râles may be finer still, the dullness less clearly made out or absent; a patch of true subcrepitant or even crepitant râles may rarely indicate a beginning caseation. A lesion of this kind may be called a compound lesion. It represents at least three stages of development: first, the stage of cavitation in which the disease has burnt itself out; second, a stage of the development of large foci under conditions of fairly good resistance; third, a succeeding stage in which resistance has greatly lessened and the disease is beginning to have its own way. A process of this kind denotes a progress of years. The prognosis depends upon the kind and number of râles in the lower parts of the lesion and whether or not there is evidence there of circumscription of the process from the presence of fibrous tissue; in short, whether or not the breathing is of the bronchovesicular type characteristic of such tissue.

Is the breath bronchovesicular, with no râles, the changes in breath sounds being slight and well diffused; dullness being elicited with difficulty? Here we have an obsolete lesion with diffusion of fibrous induration of no marked degree. If the signs are well marked, we have more extensive fibrosis. The absence of râles, even after expiration and cough, shows that the lesion is arrested. Of course the more marked and extensive the fibrous induration, the more severe has been the attack and the greater the likelihood that

caseous masses are present in the lesion. The absence of râles shows them at least to be dry and well encapsulated. We speak of this lesion as a fibrous lesion, meaning, of course, a lesion the course of which is chiefly influenced by the fibrous component. If with the same signs small indeterminate râles are also present, the prognosis of the lesion is worse, because their presence makes it probable that there is softening tubercle. We infer as to the extent and importance of such foci by the abundance and wide distribution (or the reverse) of such râles. Numerous and well-distributed clusters of moist râles lead one to think of numerous disseminated caseous foci which are softening, whereas a few râles may proceed from a bronchus irritated by an insignificant tubercle. Proceeding downward, if the lesion is dry, do all the signs cease at the same line which is distinctly marked? If so, the lesion is arrested. This sign is obtainable with more distinctness in the case of well-marked fibrosis than in the more diffuse and indistinctly marked fibrosis due to sparse and small arrested tuberculosis foci. In case of râles the lesion extends downward at least as far as râles are heard; dullness and breath changes may not be made out over its full extent. If râles extend below the other signs they will be rather small moist râles, which show a recent superficial extension of an acute kind. Patches of pneumonia may be found in such extensions, characterized by crepitant or sub-crepitant râles, but this is rare. The lesion in the case considered may extend by deposition of new tubercle below the physical signs, the foci not being apparent until inflammation has led to râles.

Study a lesion of this kind to determine the relative age of its parts and the topographical distribution of caseous and fibrous tissue. Is the lesion a simple one—that is, are the signs alike throughout, indicating cotemporaneous involvement of all parts of it, or is there an older lesion above with well-marked bronchovesicular breathing and a relatively dry lung, while patches of râles below, with harsh breathing, indicate an active chronic lesion and much fibrous tissue or with nearly normal breath sounds show a wet lung with much softening tubercle; or, again, with normal breath sounds show the presence of an acute extension? Is the lesion above fibrous with preservation of much of the alveolar structures, or is the breathing cavernous, what remains of the lung being converted into airless fibrous tissue? Are the râles rather small or medium moist râles and numerous, indicating dense tubercle deposition, or are they coarse râles produced only in the cavity? Can more than one extension be made out—a fibro-caseous lesion below

the cavity succeeded by an acute dissemination of numerous tubercles? Or, on the other hand, is the whole process arrested as to its downward progress, as proved by the fact that all signs terminate at the same level?

PERIBRONCHIAL EXTENSIONS IN THE SAME LUNG.

In lesions of the upper lobe the force of inspiration being in the direction of the ribs, tuberculous lesions are most marked or in slight cases only existent near the surface of the lung. Extensions downward implicate especially the superficial portions of the lung and are conditioned by suction of lymph from parts of less to parts of greater expansibility. But in the lower chest the lateral expansion of the thorax has less influence upon the lymph supply than the movements of the diaphragm. The front of the invader is accordingly directed downward. There is this difference in the two situations, however, that the very mobile and expansile base is in too active motion to permit the establishment of tuberculous foci. Unless pleural adhesions prevent active motion, the base of the lungs generally remains free of tubercle, at all events until shortly before death. The tubercle invasion is checked in the bronchial tubes which run downward and outward and directly downward, but such checking tends to assemble the invaders, returning them to the hilus, whence they can act as reinforcements elsewhere. The bronchi which extend laterally through the lower lobe, since their lymph channels run nearly at right angles to the diaphragmatic suction, are particularly exposed. It is common to see an extension along such a bronchus which shows itself at autopsy as a series of bronchopneumonic foci grouped about the tube. (Plate IV.) Here we have what is really an atypical peribronchial extension. During life our means of diagnosis do not permit the recognition of the fact, which is, however, worthy of note as respects the prognosis We may put the facts in this way. Extensions in the lower lobe are more apt to involve the entire course of the bronchus, from the hilus to the periphery, than extensions higher up in the lung. What we judge of as superficial extensions of perhaps slight extent are here really the outward manifestations of a very considerable process, the greater part of which runs its course in the deep lung.

LESIONS OF THE OTHER LUNG

All pulmonary tuberculosis is essentially bilateral, so far at least as the deep lung is concerned. The X-ray shows involvement of both deep paravertebral regions, but more marked as a rule upon

one side than the other. On the side less involved the process may remain restricted to the deep lung, or in time it may in its turn reach the apex and develop superficial lesions of the upper lobe which do not differ in their pathology from those of the lung first attacked. As a rule, lesions of the lung secondarily involved are larger and more acute than those of the side first affected. It is a very common error to overlook the initial superficial lesion and to consider the second as the first involvement, or, if the presence of a small lesion is discovered, to consider it secondary in point of time to the larger lesion. The distinction is made as follows: the older lesion will show obliteration or greater contraction of Krönig's isthmus, a harsher breathing, and a more prolonged expiration.

Although the first extension from the hilus is peribronchial, after the period of manifest tuberculosis is reached peribronchial extensions are almost always secondary to superficial and more or less circumscribed lesions.

When a tuberculous process has run its course and become arrested, the process having been sufficiently marked to arouse successfully all the defensive powers of the organism, the result is a certain local immunity. Tuberculosis will not develop anew at this place as readily as elsewhere in the lung. If, therefore, a patient presents evidences of constitutional impairment (fever, lassitude, purulent expectoration, etc.), and a superficial examination shows a completely dry lesion of, say, the right upper lobe, it will not do to ascribe the symptoms to this lesion—an arrested lesion has no symptoms. Especial care should be taken to examine the opposite side, in this case supposedly the left, for the slight evidences of peribronchial processes which are so readily overlooked by the careless observer. Failure to institute proper measures in season may lead to an intensification of the peribronchial process such that, when it finally forces itself upon the physician's attention, the case is quite hopeless so far as recovery is concerned; whereas, if taken in time, it might perhaps have become arrested.

Examine with especial care the character of the breathing of the upper lobe of the other side, comparing it frequently with a normal part of the lung. Do not commit the error of considering a tympanitic note over an acute lesion to be normal, the normal side to have dullness. The distinction is made by the pitch. The diseased side will have a higher pitched shorter percussion note. On the side with the broader Krönig's isthmus is there also a lesion? Is the bronchovesicular quality of the breath sounds less marked, showing a more recent extension? Are râles present showing activity?

If a superficial lesion is not made out, does careful comparisons of the breathing of this side with a normal part of the lung show a bronchovesicular quality to be present? Does it extend throughout the upper lobe? If so, there is a peribronchial extension. This may be purely lymphangitic, or, being of greater severity, it may still be arrested, in which case there will be no râles and the prognosis is good. If râles are present, they vary from very abundant to scanty. The prognosis is bad in proportion to the abundance and distinctness of these râles.

Do not expect to find, as a rule, râles which break near the ear; the early râles of peribronchial tuberculosis are indistinct and atypical. It is as if one were obtaining signs of a process which is evolving nearly out of reach. It is important to exclude a massive peribronchitis, limited to the deep lung, which sometimes occurs. The characteristic physical sign of this process, when well marked, is a limitation of the expansibility of the lobe involved, not to be explained by other factors (pleural adhesions), and a higher pitched percussion note on strong percussion as compared with the symmetrical point on the other side. The percussion stroke should be heavy, in order that it may set the entire side in vibration, the idea being to see whether the fundamental note of the lower thorax is altered by a loss of homogeneity through deep infiltration. A radiograph is of immense assistance in the determination of such cases.

THE BILATERAL TYPE OF PERIBRONCHIAL TUBERCULOSIS

We consider here only those forms of fibroid or cirrhotic change which can be ascribed to tuberculosis. The presence of tubercle bacilli in the sputum and the history of tuberculous disease are important data in the diagnosis.

In cases with high immunity in which the process at one time has been severe, the X-ray shows both lungs involved with long and heavy streaks radiating out from the hilus, following the normal course of the bronchi and blood vessels and representing these structures thickened by an enveloping fibroid induration. The two sides are not universally or equally involved, but on both the induration extends well into the lower lung. This condition may develop and become arrested without leading to conspicuous symptoms, the extensive fibrosis revealed by the X-ray being often greater than signs would have led one to anticipate. In other cases the shadows are massive and the course of the tubes and vessels is no longer apparent. The enormous formation of fibrous tissue speaks for a high original immunity, but at the same time an immunity which

PLATE I. Tubercles of upper lobe calcified, of lower lobe fibrous. Lesion of lower lobe probably a sparse peribronchial tuberculosis which is practically cured

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PLATE II. - Upper lobe converted into a fibrous mass interspersed with multilocular cavities. More recent tuberculosis below, mostly of superficial part of lung. Note that the downward extension of the lesion appears to coincide with that of the pleuritic membrane.

PLATE III.—Upper lobe a fibrous mass with cavities. Large caseous lesion at base, probably due to aspiration.

PLATE IV.—Fibrous upper lobe with cavities. In lower lobe peribronchial tuberculosis which has extensively invaded the parenchyma in lower portion. The fine-grained caseations are characteristic of tuberculosis of the acini, the terminal expansions of the bronchial tree.

PLATE V.—Upper lobe a deformed mass of fibrous tissue, universal pleural adhesions over lower lobe. Peribronchial extension throughout lobe.

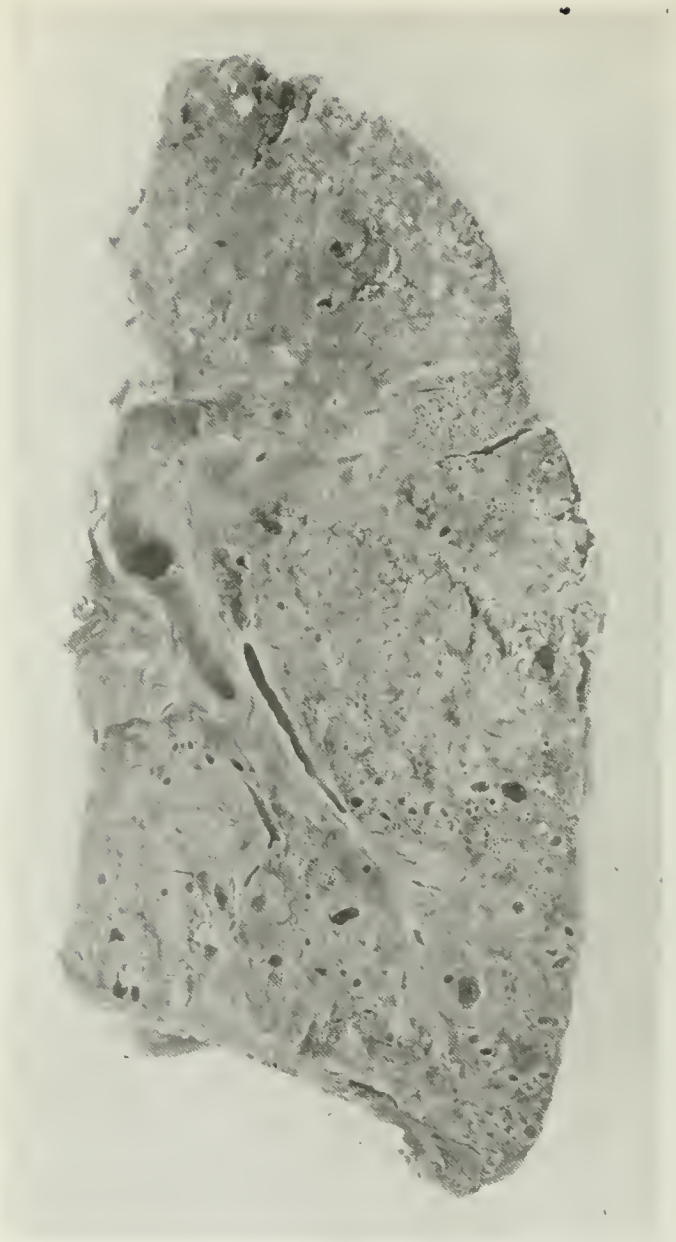

PLATE VI.—Very old tuberculosis with subacute recurrence. Calcified tubercle at apex, caseated tubercles of upper lobe. Areas of tuberculous pneumonia throughout. The portions which appear indistinct are areas of gelatinous pneumonia.

PLATE VII.—The entire upper lobe is caseated as result of tuberculous pneumonia. The comparatively healthy lower lobe has shrunk from immersion in alcohol. The upper lobe, having lost its elasticity, remains unaltered in size.

PLATE VIII.—Illustrates in upper lobe the formation of cavity from the breaking down of caseations. In lower lobe miliary tuberculosis of rather chronic type.

PLATE IX.—Old mostly calcified tubercles at apex. Recent miliary tuberculosis of entire lung.

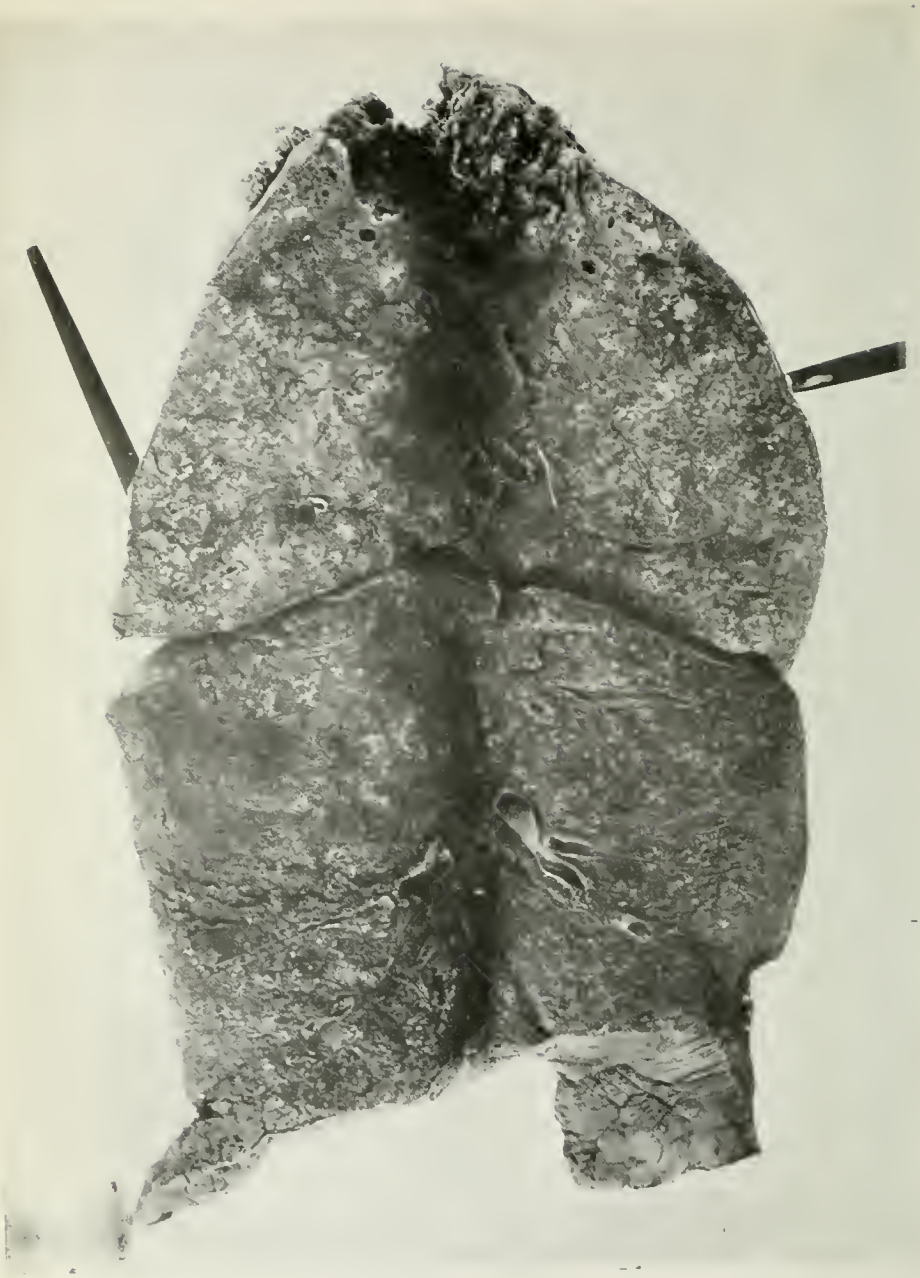

PLATE X.—Small cavity and a few old tubercles at apex. Rather recent miliary tuberculosis throughout.

PLATE XI.—Recent miliary tubercles throughout. The sparseness of the dissemination renders the irregularity of distribution apparent.

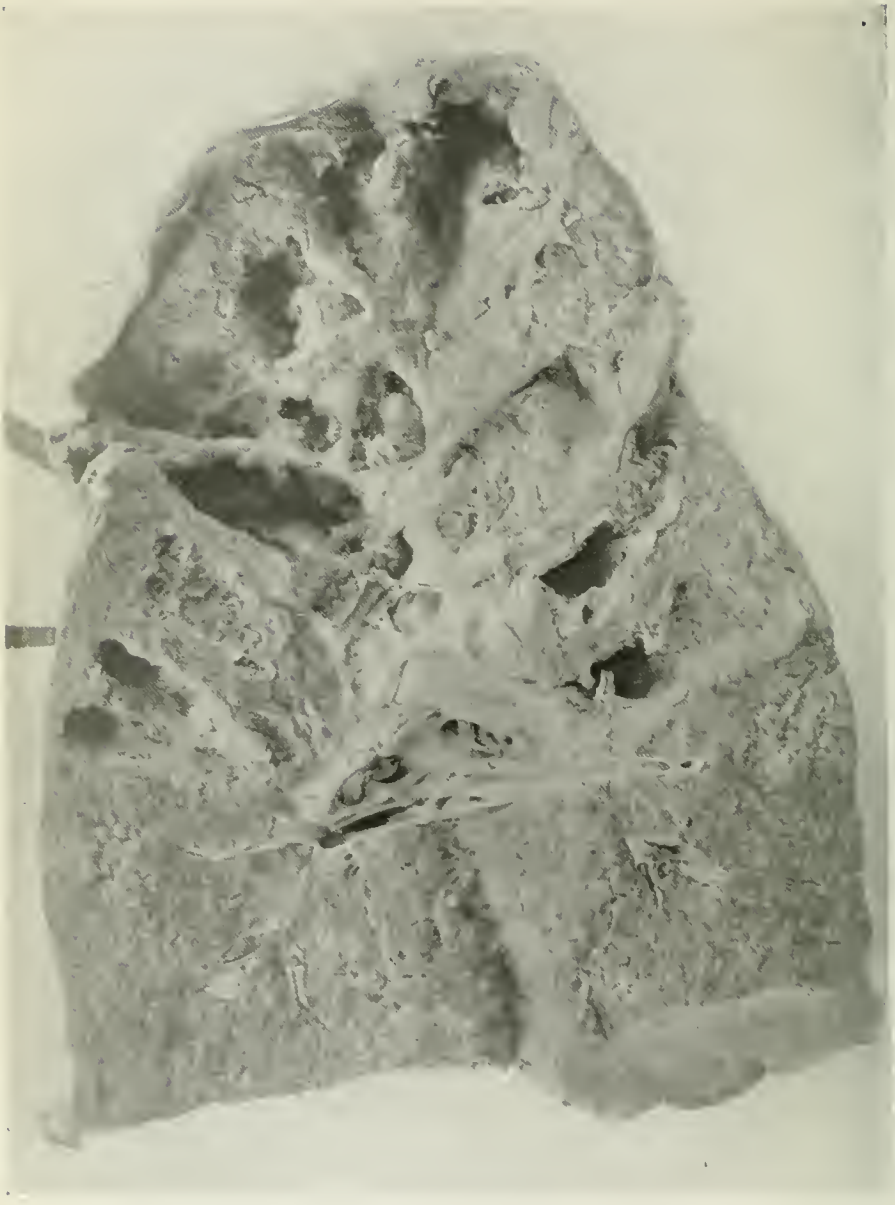

PLATE XII. Illustrates the formation of cavity developing as an acute process. Lung studded thickly below with miliary tubercles which, as centers of pneumonic inflammation, project like knobs from the cut surface. Hence the name tubercle.

has been excessively stimulated; in other words, there has been a strong reaction to the presence of widely spread tubercle bacilli and bacillary poisons. The more massive the indurations the more likely therefore that they contain disseminated tubercles. Such tubercles may have become calcified or fibrous at the time of examination, so as probably no longer likely to be of harm, or they may be a source of great danger. The distinction is twofold: first, the presence or absence of râles; second, the general condition of the patient as respects emaciation and fever. The râles are indeterminate, not very large nor very viscous. They may be disseminated irregularly over both sides; they may be irregular in their appearance, being heard for example over the back on both sides at one examination, again only or chiefly on the right; and still again only or chiefly on the left. No favorable deduction should be drawn from the diminution or disappearance of those râles unless such changes be shown to be permanent. This they almost never are.

The system has put forth enormous efforts in laying down the almost incredible amounts of fibrous tissue. Notwithstanding these efforts the râles show that the defense has been a failure, a secondary crop of tubercles has made an invasion, and this is really the beginning of the end which, manifesting itself usually as a miliary extension, is deferred more or less according to the patient's mode of life. The breathing in both types is harsh, with prolonged expiration. Dullness is distinctly present. The transmission of the voice is increased, but owing to the bilateral character of the affection gives little useful information in typical cases. In those cases in which extensive fibrosis has been superadded to an originally slight, well-encapsulated lesion there is no cough and expectoration. If a cavity of the upper lobe has not dried up, the sputum is characteristic of that condition. Cough and purulent sputum in conjunction with râles, in cases in which no unhealed cavity exists, are too often an ominous sign.

ACUTE PERIBRONCHIAL TUBERCULOSIS

There remain to be briefly described those cases in which there has been a sudden and extensive formation of tubercle about the bronchi. In the cases seen by the writer this has occurred on the heretofore healthy side, opposite an old and apparently nearly or quite healed lesion. The disease may develop without warning in persons who believe themselves quite well. In this dreadful type of peribronchial tuberculosis the masses of tubercle are grouped so thickly about the bronchi that the latter become inflamed. The

peribronchial becomes bronchial tuberculosis—that is, the process progresses toward the lumen of the bronchus, in some places it perforates at an early date, and there is bacilli-laden sputum. Over long stretches the tubes are as yet only stiffened with inflammatory exudates and the mucosa is irritated and swollen. A reflex cough is excited, which is incessant and perfectly hopeless as to results. The only relief for the unfortunate patient is efficient doses of morphine, the effect of which, however, soons wears out. The spasms of cough generally terminate with vomiting, which is further favored by the large doses of morphine, and the patient is speedily worn out by the addition of inanition to his other troubles. The breathing in this class of cases is of the bronchovesicular type, perhaps harsher and louder than in less severe cases. Here, exceptionally, the breath sounds are conducted along the bronchus by an acute inflammatory instead of a fibrous induration.

LARGE SLUGGISH LESIONS

The large lesion which has been described with the cavity or the well-marked fibrous area above, succeeded by smaller cavities or by relatively small caseous foci imbedded in a more or less abundant fibrous tissue, to be perhaps succeeded in its turn by a series of much smaller, more or less closely aggregated tubercles, is a condition which presents sharply drawn characters. It is typical in its development and is easily diagnosticated, the physical signs are readily heard through the thin chest wall, and there is perhaps just a shade of dyspnea which results in a force of breathing well calculated to make the auscultatory signs distinct without conscious effort on the part of the subject. The most salient characteristic of a lesion of this class is its development according to law. There are individual differences, of course, of omission or of intercalation, but on the whole there is a typical course which is determined by two factors —the immunity of the individual on the one hand, and, on the other, the relative mobility of the part. Hence we expect cavities and fibrous tissue at the summit, followed by progressively smaller and more numerous lesions as the mobility of the lung increases downward and the lapses of immunity become more serious. The lesions might be compared to a mountain—craters extinct or active at the summit, farther down caves, and, still farther, stratified rock of various kinds. But there is the difference that, whereas in the mountain the age of the different levels increases downward, in the lung the lowest stratum of tuberculous tissue is the most recent—a topsy-turvy geology, as it were.

But there is another class of cases in which the diagnosis is not so easy. We distinguish two types. The first is obscure in its manifestations because the lesion consists essentially in a disseminated fibrosis, which from its nature does not give very sharply marked signs. The problem here is to determine by comparison with the other side whether or not the tissues have been impaired in resonance and have had their conductivity of sounds increased, with the further important question: Is there evidence of the presence of disseminated tubercle and, if so, are these foci in a condition of activity? The problems which such a case presents are not difficult of solution for one whose ear is trained to detect minute changes in breath sounds and percussion note, except so far as the decision as to amount of caseous tissue present is concerned. The difficulties of the inexperienced are due to two causes: first, expecting to elicit well-marked physical signs; second, giving morbid significance to normal topical variation in breath sounds.

But there is another class of cases with larger and older lesions in which, while they are still no doubt subject to law, the laws which govern are plainly quite different and less easily explained, and the lesion when interrogated stands mute, it may seem, to the uninitiated, or gives out information as to its nature but sparingly. Such a lesion is usually found in cases of long standing in which the patient has been under favorable conditions as respects food and rest, but has been slowly retrogressing. If one examines such a lesion, dullness is present nearly everywhere over the thorax, breath sounds are faint or inaudible over the greater part of one or both lungs, râles are atypical, found here and there, differing in number and distribution at succeeding examinations, and the conduction of the voice is rather diminished than increased. In short, the examiner may conclude his examination with the feeling that there is undoubtedly a tuberculous lesion, but that the determining of its age, distribution and prognosis is a very different matter. In such a lesion the difficulties of diagnosis are largely due to the presence of extensive plastic pleural exudates which act in various ways to obscure the physical signs. Chronic tuberculous affections of the superficies of the lung are, as a rule, accompanied by a certain amount of plastic pleurisy. Pleurisy of this kind can only occur when the tuberculous involvement of the visceral pleura and underlying lung is slight and chronic. In other words, adhesions cannot form over large caseous foci. The beneficent effect of pleurisy in prolonging life is not always considered. In its absence the first good-sized caseous tubercle that breaks down upon the surface of the lung will infallibly lead to pyopneumothorax. That this complication is compara-

tively rare is the best proof of the rôle of the pleural adhesion. We expect, then, more or less pleurisy to accompany every well-marked and large chronic lesion.

In cases with high immunity, in which lesions develop slowly and are well demarcated, the pleurisy is, as a rule, limited to the immediate vicinity of the lesion, leaving the lower lung free to expand in respiration and thus check the downward progress of the disease. (Plate II.) In such cases we find that the basal parts of the lung furnish strong respiratory sounds, and the autopsy shows this portion of the lung to be free of manifest tubercles. But in cases of less immunity, especially in the lung secondarily involved, in which a disseminated extension has taken place, pleurisy may tie down the entire lung, even involving the diaphragmatic pleura. (Plate V.) A lung thus affected operates under different laws. It is in a condition of enforced rest, is incapable of full expansion and, under ordinary conditions, does but little work of respiration. It therefore comes under the influence of the law that lesions forming under conditions of rest will be larger, more discrete, and more likely to break down into cavities. One sees rarely at autopsy a lung completely adherent everywhere through which are interspersed large caseous foci, such as are characteristic of the upper lobe lesion. Usually, however, the lesions have been laid down before the lung has become motionless, in which case they are small and numerous, and the question is: Will the effect of rest be helpful or harmful? The answer is, helpful if the dissemination is sparse, in which case the individual foci may become fibrous or calcified; harmful if the dissemination is dense, the stagnant poisons then tending to break down the healthy tissue between the tubercles, with the result that the lung melts down into a vast cavity if life is sufficiently prolonged.

In the majority of cases, however, the termination is neither fibrosis nor cavitation. The lesions, neither very sparse nor closely aggregated, pursue an extremely sluggish course, and the patient is generally carried off at last by some complication such as pneumonia, or his entire loss of immunity is shown by a final crop of miliary tubercles in the lungs or throughout all the viscera.

Even in these cases the signs of a former immunity may be shown by the difference in behavior of the two lungs. In one the tissues are drier, there is a sharper respiration, there may be old cavities in the upper lobe, the lesion is more sharply demarcated below, the lung below the lesion may be free of morbid signs, and the respiration of the individual may be largely carried on by it; whereas, on the other side, the breathing is faint, often apparently normal, râles are indeterminate, rather large and few under ordinary breathing,

sometimes developing showers after effective cough. The percussion note is dull everywhere, sometimes approaching flatness in the lower axilla. Flatness is, of course, a sign which should at once lead to the suspicion of the presence of effusion. But in the class of cases under consideration the percussion note is very dull, rather than flat. Fremitus is absent, but vocal resonance can still be obtained. This is known as Kuthy's dissociation phenomenon. The discoverer explains the absence of fremitus by the supposition that the voice cannot cause a commotion of the thoracic wall because the vibrations are checked in passing through the non-homogeneous stratum of the thick plastic adhesions, whereas the sound of the voice, having greater penetration, still reaches the ear.

In studying these difficult cases, determine first which lung has the older lesion. Often the patient knows only of the older lesion, believing his disease to be unilateral. Fibrosis and cavity above, succeeded below by well-marked bronchovesicular breathing throughout the lesion, the lower edge of which is sharply demarcated, the breathing at the base being free, and exaggerated or puerile in character, are favorable signs. The prognosis of this lesion depends, however, chiefly upon the number, density (abundance) and size of the râles following cough. Usually the lesion is a wet lesion, approaching in its character that of the newer lesion of the opposite side. The more recent lesion is characterized usually by absence of cavity, or cavities when present will be recent, and by feeble respiration with inability to increase its force above a certain slight degree. Often the examiner will believe that the patient is making no effort to breathe until comparison with the other base shows powerful respiratory movements with correspondingly loud breath sounds there. Vocal resonance may be less loud than on the other side, but everywhere present. The presence or absence and the distribution of vocal fremitus furnish a clue as to the density and thickness of the plastic exudate of the pleura. The lesion is a wet lesion, the number, size and density of the râles constituting the best guide to the condition as respects caseous foci. In general the prognosis as respects prolongation of life is better the more obscure the physical signs, and it is to be determined partly by the amount of fibrosis present, but chiefly by symptoms (fever, expectoration, emaciation, loss of strength, etc.) rather than by signs. Here, as in other advanced lesions, the observer should be on his guard against drawing favorable conclusions from the absence of signs of moisture if the patient's general condition is distinctly bad.

In studying these lesions Krönig's isthmus may not indicate the

age of the lesion, being contracted on both sides. The older side may show a sharper breathing, a smaller lesion, a free base, perhaps a larger cavity. Are there extensive pleural adhesions as shown by restricted breathing? Are vocal resonance and fremitus increased, showing the influence of the parenchymatous lesion, or diminished, showing an extensive plastic deposit in the pleura? What is the amount of fibrous tissue? Are there extensive areas with dullness and harsh breathing but without râles, or is the whole lung wet and the bronchovesicular quality absent or but slightly marked in the respiration? Do showers of râles on expiration and cough show that there is inflammatory reaction or softening tubercle, or are the râles few and coarse from cavities or irritated bronchi? The prognosis will probably be determined by the condition of the more recently involved side. Is the lung involved throughout or to a lower level than the other side? Bear in mind the effect of extensive pleural adhesions in restricting the breathing so that less information will be obtained from study of breath sounds. Percussion gives much useful information here. Distinguish the very dull note of plastic exudate from that of the more resonant parenchymatous lesion. Is the newer tubercle breaking down? Are there indications of a cavity of the lower lung? Do not forget to exclude empyema and localized pneumothorax. Consider carefully the patient's general condition and bring it into relation with the physical signs.

There is one class of cases apparently similar to those just described, which presents great difficulties in diagnosis and prognosis. It may be described as a lesion with all the evidences of advanced disease, dullness, changes in breath sounds, abundant moisture, etc., in which the patient's general health is good entirely out of proportion to the apparent gravity of the lung conditions. The writer has in mind one case in which the breathing of the right lung was greatly restricted and the lung was everywhere full of râles, in which there is rarely fever, the nutrition and appetite excellent and the patient so little conscious of ill health as to be desirous of accepting a commission in the Medical Reserve Corps. Here we have a case in which firm adhesions interfere with the play of the lung and lead to stagnation of the lymph, the moisture apparently being due in large measure to such stagnation rather than to the exudation of active inflammation. It is probable that the fluid in the lung of such cases is due in part to errors of metabolism, but this is a point which demands further study. The determination of such cases is made by the dissociation of signs and symptoms. The patient's con-

dition appears desperate from physical signs, but the symptoms indicate a very tolerable, though of course precarious, state of health which may be enjoyed during some years. Here, as in all advanced cases, symptoms furnish the surest clue to the prognosis.

THE CAVITY

Cavities result from the death and absorption of pulmonary tissue. They are divided into superficial and deep, open and closed cavities. Occasionally a cavity of the upper lobe is seen in which the entire interior of the lobe has been scooped out, leaving walls of air-bearing tissue. Such a cavity is difficult of diagnosis, especially as respects its extent, even a thin wall containing air-filled alveoli having an extraordinary effect in diminishing the conduction of sound. As a rule, however, the cavity, especially the large cavity, has destroyed the superficial lung so that its external wall consists of little more than the two layers of the pleura glued together and firmly adherent to the ribs. From such a cavity sounds are conducted with startling distinctness. Most characteristic is the conduction of the voice and the whisper. Spoken words seem to be enunciated from the depths of the cavity; hence the term *pectoriloquy*. Whispering pectoriloquy is equally or more distinct in its peculiar reproduction of spoken words than is phonation. The râles produced vary greatly, according to the quantity of fluid present and the resonance of the cavity walls.

A very large cavity is always a more or less wet cavity. Small cavities are difficult of diagnosis. Occasionally a cavity is detected by the X-ray which gives no physical signs. Conversely a cavity may be diagnosticated by physical signs which is not shown on the radiograph. A closed cavity gives no certain physical signs. If full it is equivalent to an abscess. The presence of such a cavity may be suspected if its location and weight are such that it exercises a pull upon the pleura, in which case there is the characteristic hopelessly unproductive "pleural" reflex cough, which, once heard, will always be remembered. A deep cavity also presents some difficulties in diagnosis. The marked physical signs due to the resonance of the walls of the superficial cavity are absent. (Plate XII.) Often the only sign is a respiration in which inspiration is almost inaudible, expiration very prolonged and deep-pitched. A variety of the deep cavity is the serpiginous cavity, which appears at autopsy as a narrow sinuous tube extending sometimes far down into the lung, as if the process of its formation had consisted in a progressive melting away of the bottom of the sac. Its importance lies chiefly in the prognosis of hemorrhage. When in its downward course a cavity of this kind

encounters a blood vessel, hemorrhage is likely to ensue, which is raised with difficulty, the greater part of the effused blood infiltrating the surrounding lung. The fact that hemorrhage may appear to be slight or that it ceases altogether is of no importance if the patient's face becomes cyanosed. This is a fatal sign, evidence of the extensive infiltrations of the deep lung with blood which the autopsy will speedily reveal.

If the breathing is characteristic of cavity, we have to determine the size and position of the cavity and the condition of the surrounding tissue. Are the sounds from the cavity very marked, reaching the ear with the greatest distinctness? Is the percussion note tympanitic or very resonant? We infer, then, that the cavity is superficial and the pleura adherent. Passing in all directions from the point where the sounds are most distinct, the patient counting vocally or in a whisper, note where the pectoriloquy, though still plainly heard, becomes less loud. We are now over lung tissue, but it is not always easy to determine whether the cavity still extends behind that tissue, the difference in sound being merely due to the interposition of a thicker wall, or whether the sounds are reflected downward into uninvaded territory. However, the important question is: What is the condition of the surrounding tissues or, what amounts to nearly the same thing, what is the nature of the cavity? Is it progressing or stationary? The walls of the cavity may be of smooth and firm fibrous tissue throughout, or of sloughing masses of caseous material, interspersed among thickly studded softening yellow tubercles of small size; or there may be intermediate cases in which the tubercle persists in only a portion of the wall, usually the floor. The first type is characterized by the distinctness and metallic quality of breath sounds and râles, often by the scantiness of its contents (shown by the fact that râles are only elicited at the base of the cavity) and by their frequently tenacious character, the blast of strong respiratory movements of air producing what are plainly waves ruffling the surface of a mucilaginous pool, as it were.

When the walls, on the other hand, are soft and crumbling, the sonority of the acoustic phenomena is much diminished. Pectoriloquy is still present, but one fails to get the impression of a resounding cavity. On expiration and cough the sides of the cavity are brought into apposition. Their separation in the following inspiration is sometimes accompanied by a whiff and by a sound resembling numerous simultaneous moist râles. The contents of the cavity are usually much more abundant and râles of varying quality are obtained at a higher level. If the break-

ing down is rapid and the fluid largely pus, râles are not necessarily conspicuous or peculiar. In some very advanced cases, however, there is an extraordinary viscosity of the greenish-yellow, often blood-stained, sputum which has been ascribed to the presence of nucleinic acid. In such a case the sputum hangs in ropes in the patient's mouth, and he often attempts to extract it with his fingers after repeated failures to expel it in the usual way. In the cavity the same viscosity of its contents leads to the most remarkable variety of râles, snoring, bubbling, creaking râles, the sound of "new leather," simulations of friction rubs and the like, the diagnosis of which, if there is doubt, is speedily cleared up by the change effected by a coughing fit. The sputum varies with the nature of the cavity contents, mucous or mucopurulent, viscous, comparatively scanty and raised with difficulty in the first type, more abundant, more frankly purulent, easily raised in the second type, raised with some and expelled with more difficulty in the variety just described. If the cavity is not large, we must ask ourselves the question: What is the character of the remaining solid structures? About the encapsulated cavities, which may be multiple, there are masses of fibrous tissue that are completely destitute of patent alveoli. (Plate III.) In such cases no respiratory sounds are forthcoming from the surrounding parts, the indurated tissues of which transmit the cavity sounds with great distinctness. The condition of the air-bearing tissue in the neighborhood of the cavity is determinable by criteria already discussed. A bad combination as respects general prognosis, and also in the present case the probability of extension of the cavity, is apparently normal low-pitched respiration, with an abundance of râles, and, worse yet, is such an abundance of râles as to render the breath sounds inaudible.

One variety of the cavity which sometimes escapes the unwary is one in which the lumen of the cavity is practically obliterated by a dislocated heart. Some change in the heart's position probably occurs in every case of at all extensive cavity, the lung on the healthy side expanding to fill the vacancy and pushing the heart before it. In some cases the dislocation of the heart may be marked, the greater bulk of the heart being found to the right of the median line of the sternum, or in the left-sided cavity it may be tucked away well up toward the axilla. He who does not percuss out the heart and determine the location of the apex beat as a part of his study of lung conditions is doomed to an occasional unpleasant surprise. One more word on this subject. Do not ascribe any signs of failing heart or possibly venous obstruction to a kinking of the great vessels as the result of the heart's displacement. The heart can be swung in

any direction within the thorax without leading to any diminution of caliber of these vessels through undue approximation of their walls, as dissections have convinced the writer.

MILIARY TUBERCULOSIS.

The term "miliary" relates merely, of course, to the size of the tubercles. A better name would be "disseminated hematogenous tuberculosis." The complete failure of immunity, which so often immediately precedes and is the cause of death in tuberculosis, is the signal for the development everywhere of tubercle, often minute and determinable only by the microscope, sometimes of a more chronic type and appearing as macroscopic yellow tubercles. It is incorrect to speak of death as occurring from miliary tuberculosis in such a condition. The term should be reserved for cases in which there is a large or a universal dissemination, often from an old and apparently insignificant focus, of minute tubercles which constitutes the principal disease. Much study has been expended upon the causes of this condition, but the point upon which especial emphasis should be laid is, that the initial condition which is the real cause of miliary tuberculosis is the complete failure of immunity which allows collections of tubercle bacilli to be set free and to establish everywhere new colonies. Miliary tuberculosis as studied in the lungs gives at the outset no signs and symptoms. It is invisible to the X-ray. In physical examination of the chest, in a case in which the overwhelming of the vital forces is apparent, day after day no signs are obtained. At last distant and faint atypical indeterminate râles are to be made out. By this time there is a characteristic restraint of the breathing. The lung expands slightly and ineffectually and gives the impression on auscultation of a body which moves slightly amid wet surroundings. If life is prolonged until softening of the tubercle has taken place, the râles are more characteristic and nearer the ear, and the X-ray gives evidence of a multitude of minute shadows.

Hematogenous disseminations of tubercle may be sparse or dense. Their characteristic feature is their irregularity of dissemination. (Plate XI.) Peribronchial tuberculosis is known at autopsy by the occurrence of "clover leaf" groupings of tubercule, which represent sections of bronchi and bronchioles filled with caseous material or with pus. When section at autopsy shows thickly set tubercles, in great part of the same size and equally placed, the condition is not miliary tuberculosis, but the last stage of a bronchitis or bronchiolitis which is the termination of the most marked forms of peribronchial tuberculosis.

REPORT ON NEURO-CIRCULATORY ASTHENIA AND ITS MANAGEMENT[1]

By THOMAS LEWIS, M.D.

WHEN it was decided by the Director General of the British Army Medical Service that the original experiment of creating a special military hospital for heart cases in this country had proved a success, he also decided it would be advisable to enlarge it to several times its original capacity; the chief difficulty in giving effect to the last decision lay in obtaining the requisite staff of medical officers. In this difficulty I bethought myself of my many friendships with American physicians and quickly learned, through the kindness of Maj. Theodore C. Janeway, M. O. R. C., that the services of a number of American officers of the Reserve could be made available, and that these officers had at once expressed their willingness to help us in our difficulty. The timely aid which we have thus obtained was most welcome, and was specially welcome to me personally, in that several of these officers were old colleagues of mine in the research laboratory.

But, although the depletion of our own medical services was the urgent reason for American assistance, a second and equally important reason was in mind. The early experiences of our service in dealing with cardiac disorders had been by no means a happy one; the frequency of Da Costa's "irritable heart of soldiers," renamed in the present report "Neuro-Circulatory Asthenia," being so considerable and methods of dealing with it so little known or understood. It seemed eminently desirable that, while many of our own early blunders were irremediable, no effort should be spared to safeguard the medical service of the young American armies from similar pitfalls. This object could not be better served than by giving, so far as we were able, the whole of our experience to selected officers of the American medical service, working with us in active coöperation. This we have attempted to do in the past four months, and the present report sums up in a very admirable fashion the views adopted by those of us who now have several years of special experience of these patients; the report should have a special value in that it is a message to American medical officers from their own countrymen and in that it confines itself to statements of fact and to suggestions of policy which have an immediate practical bearing. The suggestions in regard to the examination of recruits are suggestions now

[1]Approved for publication in THE MILITARY SURGEON by the Director General, R. A. M. C., and the Surgeon General, U. S. Army.

adopted by the British recruiting authorities; had it been possible to adopt them at an earlier stage of the war, very many thousands of recruits who have in fact proved more than worthless would never have been accepted; the time and money lost in training and equipping these men would have been saved, and in the future the country would be saddled with fewer pensioners.

The system of aggregating the affected soldiers in *convalescent* institutions has obtained a firm footing, not only here but in the war area and in the Canadian army.

In selecting men for arduous work, in sorting out hospital patients for various grades of work, the observed capacity for such work is the chief standby. That such should actually prove to be the case would seem obvious. Yet the very obvious is often precisely that which fails to gain general or ready acceptance.

Prognosis for army purposes is far easier and far more certain than a general prognosis, for the prognosis is applied mainly to capacity in a single direction, capacity for physical endurance. Opinion in this country, formed on the experience of this war, is rapidly hardening to the view that the exercise tests, applied not only to those suspected of cardiac inefficiency, but much more generally, is *par excellence* the first guide in selecting recruits or convalescent soldiers for the various grades of duty.

Introduction.—Under conditions of modern warfare an appreciable number of soldiers present a well-defined symptom-complex, in which certain nervous and circulatory symptoms are associated with an increased susceptibility to fatigue. The descriptive name of Neuro-Circulatory Asthenia ("N. C. A.") is suggested for this syndrome in preference to Disordered Action of the Heart ("D. A. H.") which, in accordance with the official nomenclature, must be used in the British Army.

The condition certainly occurs in its milder grades in civil life, but becomes intensified, better defined and exceedingly common under war conditions. Its prevalence in the Civil War was recognized by Da Costa, and his admirable, graphic description of the irritable heart in soldiers still stands as a model of direct clinical observation, even if his account does not define the condition sharply. The disorder was also observed during the Crimean War, during the South African War by Dr. Tyson, and subsequently among soldiers returned from a campaign at the Indian Frontier by Captain McCarthy. Its prevalence in the British, French and German armies during the present war is easily accounted for when one considers that modern warfare means prolonged marching, intense fighting.

terrific bombardment, shell shock, gassing, burial, trench fever, dysentery, other infections and wounds.

It was for the investigation and general management of these cases that a special military heart hospital was organized by the British, first at Hampstead, London, and later at Colchester in Essex. The work has been in progress for two years now, and for full details of its methods and results the invaluable report[2] written by Dr. Thomas Lewis must be consulted. The hospital at present has a capacity of about 700 beds; its limited size permits the admission only of British Expeditionary Force soldiers. The staff, in addition to performing the routine duties of medical officers, act to a certain extent in a teaching and consulting capacity. Six of the medical Officers Reserve Corps, U. S. A., who had previously been identified with heart work, were detailed by the Surgeon General to this hospital for purposes of instruction. All six of these officers appreciate the advantages of actual observation of this clinical material, and have had ample opportunity to recognize the value and success of the present management of these cases. Two of the officers came here immediately afer completing their duty of making special examinations for cardio-vascular disease and pulmonary tuberculosis among the federalized National Guard of New York, and although they followed the perfectly sound instructions from the Surgeon General's office they now feel that potential cases of N. C. A. were passed by them without a full realization of the possible future of this type of soldier.

The object of the present report is primarily to attempt to give a vivid clinical picture to those unfamiliar with the disorder as it occurs in soldiers. The presentation will be entirely practical and confine itself to facts, without entering into a discussion of the fundamental pathology or of the detailed scientific investigations which have been pursued by others and in part published in the above-mentioned official report. The relation of this syndrome to many probably closely allied conditions, previously described in medical literature, must also be omitted. We shall attempt to give a clinical picture, the symptoms, subjective and objective, the management of these cases, and finally we shall venture to call attention to some obvious measures which may, so it is hoped, limit the occurence of this affection in the American Army, both at home and at the front.

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[2]Special Report Series, No. 8, National Health Insurance, Medical Research Committee. Published by His Majesty's Stationery Office, London, 1917. Price, one shilling. An excellent abstract and editorial appeared in the J. A. M. A., 1917, lxxix, pp. 231 and 202.

Nomenclature.—In choosing a descriptive name for this syndrome—it is *not* a clinical entity—we have hit upon Neuro-Circulatory Asthenia as the best among many terms that have been suggested. It would be a mistake to introduce into the American Army the name "Disordered Action of the Heart" for, after a soldier has once been so labelled, it is difficult subsequently to persuade him that he is not suffering from organic heart trouble; this in itself retards his progress. Dr. Lewis' suggestion, "Effort Syndrome," in the sense that the symptoms are brought on or intensified by effort, is apt, but used with the implication that the syndrome is identical with that presented by a normal man after severe physical exertion, it involves us at once in a new discussion. Neuro-Circulatory Asthenia (N. C. A.) was selected because it was descriptive, non-committal, and shortened to "N. C. A." would be understood, and not misunderstood all along the line.

There is sent, then, to this heart hospital a heterogeneous collection of various affections with nervous, circulatory and asthenic symptoms. Among them there may be cases of pulmonary tuberculosis, organic cardiac and vascular disease, exophthalmic goitre, syphilis, epilepsy, alcoholism, etc., in which case the patient is classified under the appropriate diagnosis, and the neuro-circulatory asthenia may be said to be symptomatic or secondary. In the majority of the soldiers, however, no definite pathological condition can be found to which to ascribe the clinical symptoms, and for *practical* purposes the N. C. A. may be considered to be idiopathic or primary. The body of this paper concerns itself almost entirely with this latter group.

Etiologic Factors.—These may be divided into (1) predisposing and (2) exciting; very often a history of both causes is obtained.

About one-half of the cases give a definite history of symptoms previous to enlistment, and these are classed rather loosely as "Constitutional"[3] cases. When the early history of a considerable number of these soldiers is elicited, one finds some who from youth up have given indication that physically they were not quite up to the average; very often they have always been weak or delicate, have never been able to play the more active games like football; perhaps they have had dyspnea on exertion, or attacks of syncope, have always perspired too profusely or flushed readily, never been able to do heavy work, and have chosen light work or sedentary occupation.

[3]"Constitutional" is a term used in the British Army to designate those cases which had symptoms or defects prior to enlistment. It is employed in this paper not in its strict sense, but merely to indicate "preënlistment" cases.

Among the "constitutional" cases are also the neuresthenic and neuropathic individuals; also those who suffer from attacks of asthma or from chronic nasal obstruction. Sir William Osler put it picturesquely—"something wrong with the blastoderm." Age also plays a decided rôle; most of the patients are in the twenties, but there are men from thirty-eight years up, who, with the best of will, are not able to stand the hardships and fatigue of warfare; some of these men have early structural changes. Among the "constitutional" cases are also included those that give a history of attacks of definite acute rheumatic fever or chorea (these constitute 23 per cent of the cases according to the report). It should be noted that acute rheumatic fever is in general far more commonly met with here than in America. *Since one-half of the cases present symptoms before enlistment, any measures designed to prevent the occurrence of this disorder must lay stress on the importance of a complete anamnesis going back to childhood and even at times including family history.* What proportion of men with preënlistment symptoms eventually become valuable and efficient soldiers and what proportion a burden to the army is unfortunately not known; but certainly the best basis for classification, as will be emphasized later, is the observed effect of exercise.

Of the *exciting* factors, the infectious and the physical and psychic strain of war are the most important. Of the infectious diseases we often obtain a history of rheumatic fever, trench fever, dysentery, diarrhea, pneumonia, influenza, typhoid, pyrexia of unknown origin ("P. U. O."), malaria, etc. The period of convalescence in many of these cases has been quite inadequate. The importance of focal infections as an etiologic factor is as uncertain in this connection as it is in general. There is no doubt, however, that intercurrent infections, such as tonsillitis, temporarily aggravate the symptoms and lower the exercise tolerance. There are also cases whose onset seems associated with shell shock, gassing, or burial.

Finally, there are a great many soldiers who are constitutionally strong and were perfectly fit at enlistment, but who have become exhausted after years of active fighting; they have been "over the top" repeatedly, through several campaigns, been exposed, perhaps wounded, and are simply victims of intense warfare.

Venereal disease, alcohol, tobacco and coffee appear to play no appreciable rôle in the history of N. C. A.; but it should be remembered that the patients belonging to the constitutional type are sexually not very active, and are as a class not alcoholic, partly because they do not tolerate alcohol well, partly because they are frequently teetotallers as a matter of principle.

The chief lesson to be drawn from these exciting factors is the *importance of removing sources of infection, and of allowing a proper convalescent period after any infectious disease.* Whether in view of the increased prevalence of rheumatic fever here, cases of acute rheumatic fever should be invalided to America for their month of convalescence, is a problem which will probably present itself for future solution.

General Description.—It will be easier to gain a vivid clinical picture of these patients if it is borne in mind that we are describing not a new and strange syndrome, but a condition frequently seen in civilian practice in a milder form after an attack of "grippe," typhoid, severe tonsillitis, or scarlet fever. The general type of patient with which we are dealing is one who is readily exhausted, physically and psychically. His subjective symptoms are referable chiefly to the circulatory apparatus and nervous system; as the patient himself puts it occasionally: "It's me 'eart and me 'ead, sir," or "It's me chest and me nerves." He complains most constantly perhaps of dyspnea on effort, of feeling generally "shaky," of pains in the left chest, of palpitation, headache, dizziness and faintness. He is usually susceptible to cold and becomes readily fatigued, so that he spends his spare time seated in a listless attitude close to the ward fireplace. He is often quite aware of his tremor and complains of the fact that he perspires too profusely. It is quite noticeable in making morning rounds *before* exercise, how frequently repeated are the responses, "very shaky, sir," "pains in chest," "headache" and "slept poorly, sir"; whereas *after* physical drill the cardinal symptoms are elicited, namely, breathlessness, fatigue, chest pain, palpitation, giddiness and faintness.

Pain in the upper trunk is one of the commonest of the subjective symptoms and often one of the most persistent. It is usually referred to as "precordial pain," but as its origin is not definitely known, and as it is localized by the patient in the precordium, left chest, borders of the ribs, or, exceptionally, even in the abdomen, it may be wiser to speak of it more generally as pectoral or chest pain. Its intensity varies considerably in different cases, and its character ranges from a mere distress, dull ache, sticking, stabbing, or gripping pain to a severe anginoid pain, even radiating up into the neck and down the left arm. Sir Clifford Allbutt has called attention to the fact that the pain of true angina pectoris is characteristically substernal, whereas the pain in N. C. A. is rather more mammary or pectoral in location. Occasionally a more observing patient will notice the hyperalgesia of his own accord: one soldier stated that

his breast when touched felt "sore as a boil." Major Meakins has found that those patients who have persistent pain and hyperalgesia never reach the higher grades of physical drill and have to be discharged in low categories.

There are numerous *other subjective symptoms,* but one must be careful to distinguish between symptoms which are really a part of the clinical picture of N. C. A. and those which simply occur as an accidental accompaniment in soldiers suffering from this disorder. Syncope is not very rare in the history of these patients and has been made the subject of a special study (not yet published) by Lewis, Cotton, and Rapport.[4] The well-known sensation accompanying extrasystoles, also throbbing, choking or "stuffiness" of the throat, tinnitus aurium, fulness and bushing of the head, backache, muscular pains and stiffness, nausea, vomiting, night sweats, pollakiuria, enuresis, unpleasant dreams, disturbances of speech and voice, irritability, lack of power of concentration, and emotional instability, all occur sufficiently often to be noted. There is a striking disproportion between the severity of the subjective symptoms when compared with the rather minor abnormalities which constitute the objective signs found in N. C. A.

The objective symptoms are especially important from a military standpoint, as the conclusion of medical officers should, as far as possible, be based on objective evidence in the widest sense, including the observed affect of effort.

The features which were most striking to the American medical officers, on the first casual inspection of a group of these cases, were the tremor and the extraordinary cyanosis of the hands; but Sir William Osler called our attention to the fact that the latter condition was not quite so abnormal as it seemed, for the average "Anglican" hand is often slightly blue owing to climatic conditions. The general appearance of many of the patients is quite normal, ruddy and vigorous, but a certain proportion are poorly built, assumes a faulty posture, and as they come directly from France look debilitated, asthenic, played-out and tremulous. They often have the facial expression of exhaustion, timidity, listlessness or anxiety; never that look of "frozen fear" due to widening of the palpebral fissure, so noticeable in some classes of shell shock and exophthalmic goitre. Their complexion is sometimes pasty and pallid, but blood examination proves this to be merely a pseudo-anemic pallor. There is also an erethic type with high color, erythematous

[4] They found the syncopal attacks were accompanied by gastric disturbance, fall of blood pressure and a slow pulse (about 40). Their view, that the attacks are vagal in origin, was confirmed by the prompt increase of pulse rate after an intravenous injection of atropine.

flushing and dermographia. A few minutes after stripping to the waist for chest examination, it is a not uncommon picture to see these patients shivering (although they do not feel cold), and at the same time to note beads of perspiration rolling from the axillae along the sides of the trunk. The tremor is usually coarse and is most evident in the hands. The latter are in addition often cold, clammy, cyanotic and give the impression of a sluggish peripheral circulation.

The *examination of the cardio-vascular system,* especially of the heart, reveals interesting physical signs whose interpretation has been the subject of discussion for years. Most of them are minor abnormalities which, standing by themselves, are not evidences of serious structural disease.

On inspection the apex beat is sometimes seen to be diffuse and extended over several interspaces ("irradiation" of the apical impulse); in other cases it is forcible and even heaving, and yet there is neither dilatation nor hypertrophy of the heart. Epigastric pulsation, corresponding to the action of the right ventricle, and occasionally pulsation of the abdominal aorta are observed; by itself neither sign is significant. In certain instances the pulsation in the peripheral arteries is so striking that one not acquainted with this condition would jump at the diagnosis of aortic disease. A pistol-shot sound in the brachial and femeral arteries not infrequently occurs in the absence of aortic regurgitation, but Duroziez's sign does not so occur. Many of these signs are associated with an overacting type of heart's action.

The *heart rate* is almost always accelerated while the patient is awake; the average pulse rate of these soldiers when up and about the ward is 90 to 100 beats per minute. The "lability" of the pulse is also often very striking; unusual differences between rates in the horizontal and upright position, marked acceleration on effort, pulsus irregularis respiratorius and extrasystoles are all observed. Exceptionally, there is bradycardia, without heart block, but this is usually in older soldiers, in whom in general the augmentation in rate in response to exercise is not so marked.

Exaggerated response of pulse rate to exercise, and *decline of rate at the cessation of exercise.*—As a routine we employ the familiar test of having the patient climb a flight of steps rapidly, noting the pulse rate before and after the exercise, and how long it takes for the pulse to return to its preëxercise rate; this last period should not be over two minutes. Meakins and Gunson found in a general way that if the period of decline to the preëxercise pulse rate exceeds two minutes, the patient will later not be able to stand the

route marches and the more strenuous 30-minute exercises. Such rules are subject to exceptions After exercise the pulse sometimes becomes so rapid and thready as to be almost imperceptible (lability).

To test the *dimensions* of the heart, there is only one satisfactory method—orthodiagraphy or telo-roentgenography. Since leaving Hampstead the heart hospital has not had an orthodiagraph, and the practice here is to consider the outermost point at which the apex beat lifts the palpating finger as the site of the left cardiac border. Meakins and Gunson found this to be the best non-instrumental method as checked orthodiagraphically, but in certain borderline cases especially with over-acting hearts, it is not decisive There is no harm in submitting cases with doubtful or slight cardiac enlargement, uncomplicated, to exercise tests and deciding their capacity for military duty in that way. In determining the site of the left cardiac border, it must be remembered that there is often an abnormal mobility of the heart brought out by change of posture, so that in the left lateral position the heart may appear to be enlarged.

The cases of N. C. A. sometimes present a suggestion of a thrill, or even more than a suggestion, but this is always systolic in time. All cases with presystolic thrills belong to an entirely different group and are discharged from the army as permanently unfit.

Cardiac Murmurs.—The practice here in regard to systolic murmurs is sound; from a medico-military viewpoint, considering only the prognosis and categorizing of soldiers, it is a safe rule to *disregard purely systolic murmurs per se*, and this applies irrespective of the location, intensity or conduction of the murmur. If there is (1) no history of repeated or recent attacks of rheumatic fever, (2) no cardiac enlargement, and (3) a good tolerance to exercise, a systolic murmur as such does not influence the question of assigning the soldier to military duty. (On the other hand a history of several attacks of rheumatic fever, or of one recent attack, with slight cardiac enlargement, with severe and persistent symptoms and a low exercise tolerance, is considered ground for discharge, irrespective of the presence or absence of a systolic murmur.) No one would deny, however, that after repeated attacks of rheumatic fever the mitral valve has in many cases probably been damaged. As regards aortic stenosis, too, Dr. Lewis does not let the presence of a systolic murmur influence the diagnosis, but relies upon other criteria, such as the thrill over the aortic area, the anacrotic pulse,

low systolic blood pressure and the evidence of aortic insufficiency. Accidental and extra cardiac murmurs, such as the common cardio-respiratory murmur, are of course considered as without significance. The after-histories of patients with systolic murmurs, obtained at an average period of 11.2 months after their discharge to duty categories, showed that they did as well as those without such murmurs (Dr. Lewis in personal communication). It is needless to say that patients with presystolic or diastolic murmurs are discharged from the army; to avoid missing such murmurs at times, we find it necessary to examine all patients in the upright and horizontal positions before and after exercise, as well as while they are holding their breath at the end of expiration.

The *blood pressure* in these patients in complete repose is usually normal. The pressure is very sensitive to exercise or emotion on the part of the patient, responding by an exaggerated rise. In general there is an instability of the blood pressure.

The *electrocardiograph* has not revealed anything noteworthy in these cases. It is useful in determining right or left ventricular predominance and the nature of certain arrhythmias, tachycardias and bradycardias.

An *orthodiagraph* or upright X-ray apparatus with a radiographer, expert in chest work, is almost essential for securing the best results in such a heart hospital. Such questions as the presence of enlargement of the heart, of aneurysm, of incipient or arrested pulmonary tuberculosis, of mediastinal lymph nodes, or of tumors, could be settled more satisfactorily with such aid.

Of the *objective symptoms referable to the nervous system,* the hyperalgesia of the chest wall and the tremor are particularly interesting. The latter is seen most commonly in the hands, but quite frequently also in the tongue and closed eyelids, and not rarely as a coarse tremor of the muscles of the trunk, head and extremities. Fibrillary twitching of the pectoral muscles often give muscle sounds which interfere with careful auscultation of the chest. The coarse tremor is sometimes brought on, or exaggerated, by effort. The hyperesthesia or hyperalgesia of the chest wall has its special value in association with the local pain, as it is difficult to simulate this sign successfully. The reflexes are in general increased; this is most evident in the exaggerated abdominal reflexes and knee jerks and in the occurrence of a false ankle clonus. There is often an increased mechanical excitability of the skeletal muscles, occasionally a demonstrable Chvostek's sign. The pharyngeal, conjunctival and corneal reflexes, however, may be diminished or absent. In the

erethic type, flushing or blanching of the face may occur on excitement or effort; dermographia is common. The increased axillary perspiration noticed during chest examination has been referred to; in addition one occasionally sees the perspiration break out on the forehead, face and neck on slight provocation, after physical effort or psychic stimulus. The pupils are often unusually dilated, just as in neurasthenic individuals, but react promptly to light and in accommodation; hippus has been observed. A pseudo-ataxia has been noticed in some of the more marked cases. The temperature fluctuates, but, if one allows rather wide ranges, it may be said to be within normal limits.

The urine presents that curious phenomenon, phosphaturia, so well known in vasoneurotic individuals. The presence of crystals of calcium oxalate is frequent.

THE USE OF A SYSTEM OF GRADED PHYSICAL EXERCISES FOR SORTING AND THERAPY

The great majority of the patients treated in the military heart hospital are Expeditionary Force men invalided direct from France, and the methods of sorting and treatment used here have been developed through the investigation and observation of this class of patient.[5] Upon arrival at the hospital, the men are immediately examined, and those who have unquestionable organic disease of the heart or blood vessels (including auricular fibrillation, auricular flutter, and paroxysmal tachycardia), pulmonary tuberculosis, or who for other reasons are obviously unfit for military duty, are recommended for permanent discharge from the army. The group which remains is made up principally of cases of N. C. A., but also includes a small number of cases of doubtful valvular lesions and of questionable cardiac hypertrophy. All of these patients are placed at once upon a system of graduated exercises, which is used both as an aid in categorization and as a therapeutic measure. Experience has shown that in the doubtful cases of organic disease the tolerance of these exercises is the best single criterion by which to determine the final disposition of the case.

The exercises used have been taken from the routine army drills with such alterations as would allow for gradation in duration and intensity. There are five different drills of gradually increasing severity; the first two are 15-minute exercises, and the last three are 30-minute exercises. The longer drills are supplemented by afternoon route marches of 2 to 4 miles without pack. Five drills

[5]The same system is now in vogue in three centers in France and in the Canadian hospitals.

and four marches are given each week. The patients are seen by the medical officer in charge immediately after the first drill, and after each change of drill, after one route march a week, and at such other times as may seem desirable. A chart of the observations made at these times is kept in connection with the medical history, upon which is recorded the presence or absence of such symptoms as dyspnea, precordial pain, vertigo, weakness and palpitation. The heart rate is taken immediately after exercise and again 2 minutes later, and these counts are also recorded on the chart. More attention is paid to objective signs than to subjective symptoms, and complaints are not encouraged. When the exercise is poorly tolerated the patient appears exhausted, is markedly dyspneic, the pulse is very rapid, and its return to normal is retarded. The expression of the face is often quite characteristic; the mouth is open, the lines about the face are exaggerated and the general expression is that of anxiety and exhaustion. Marked general tremor described by the patient as shakiness is a prominent feature in many cases. The symptoms complained of are precordial pain, shortness of breath, giddiness and weakness. These symptoms are not equally prominent, but vary greatly in individual cases. When the exercises are well tolerated the picture is quite different; the appearance of the patient may be quite normal, the dyspnea slight or absent, the pulse rate relatively low, with a more rapid return to the preëxercise rate. Frequently no symptoms are complained of, or, if present, they are not numerous or severe. The patients soon become aware that they are classified largely on exercise tests, and consequently symptoms are always to be accepted with reserve. It is found better to privilege men on the higher exercises and route marches.

Advance in the grade of exercises depends on the individual reaction. Favorable cases usually remain on each 15-minute exercise three to five days, and on each 30-minute exercise about one week. They are therefore ready for final categorization and discharge in approximately six weeks. Patients whom the early exercises show to be obviously unable to stand much exertion are discharged as permanently unfit or in low categories as soon as a definite decision is reached. However, some of those who do the lower exercises with moderate difficulty eventually show improvement and are able to advance to the 30-minute drills. It is occasionally necessary temporarily to reduce the grade of exercise in individual cases. Mild infections make it necessary at times to discontinue drills for a varying length of time, especially if there is fever or general malaise.

When the patient's tolerance to exercise has been definitely determined and no improvement is to be expected, the patient is ready for final categorization and discharge. The tolerance to exercise is the most important guide in the final decision, but consideration is also given to facts elicited in the past history and by physical examination. The experience at the military heart hospital and the follow-up work done there have shown that men with a history of acute rheumatic fever are relatively unfavorable cases. This is also true, in a measure, of those who have a history of low exercise tolerance before enlistment, and of men over forty years of age. The presence of questionable valvular disease or doubtful cardiac hypertrophy is taken into consideration. The presence of any of the above conditions is sufficient cause for the reduction of the category, otherwise indicated by the exercise tolerance; *e.g.*, if a patient has tolerated all the drills and route marches fairly well and has previously had recent or repeated attacks of rheumatic fever or is over forty years of age, he would be discharged in category 2 rather than in category 1, but such a combination is comparatively rare.

Aside from the other considerations, patients who tolerate the highest grade of exercises well and perform the route marches without distress are discharged in category 1, as fit for full service. Patients who can do the higher exercises but cannot do them quite so well are discharged in category 2, as fit for further service in light or full duty categories after subsequent hardening at a command depot. When the lighter exercises only are tolerated, the patient is discharged in category 3, as fit for light or sedentary military employment at home. Cases showing a still lower exercise tolerance are discharged from the army as permanently unfit.

It cannot be over-emphasized that there is now a sufficient experience to fix almost precisely the actual amounts of duty of which these patients are subsequently capable, and, in any hospital or institution in which there are many of these patients, the numbers passing out in the several categories of discharge should be rigidly controlled. The actual figures for the different categories of discharge for all cases, unselected, should be about as follows:

	Per cent
Category 1 (full duty)	20
Category 2 (light, or possibly later full duty)	30
Category 3 (sedentary military employments)	30
Permanently unfit	20

From the above it is evident that the system of graded exercises serves a double purpose, in that it is used as a therapeutic measure as well as an aid to classification. The average hospital stay has been reduced 50 per cent by this plan and is actually six to seven weeks. As far as we know, no injury has been done by these exercises, even in the most severe cases of N. C. A. Medical therapy, such as the administration of digitalis, strychnine, alkalies, and also balneotherapy, has been tried and found to be of no value. Rest in bed has been found to be detrimental rather than beneficial. It has been thought worth while to clear up obvious foci of infections, such as pyorrhea alveolaris, infected tonsils, etc. Symptomatic treatment has been used as little as possible. The drills used at the military heart hospital are of a character to demand very close attention, and they hold the men at a rather high nervous tension. The commands are sharp and the movements are abrupt. It is not known whether more rhythmic exercises with less mental strain on the men would give different results. The value of general hygiene, of congenial surroundings, of the moral support and constant encouragement of the medical staff, should not be underestimated in the success of the heart hospital.

After Histories.—The practical value of the methods of categoriziug and treating this group of cases is well demonstrated by the after-histories of 558 soldiers treated at the military heart hospital in 1916. Of the 558 cases, comprising cases of N. C. A. only, 272 or 49 per cent were discharged in duty categories; the remainder were discharged as unfit for duty and boarded out of the army.[6] Of the 272 cases returned to duty, 262 have been traced and their status is known an average of 11.2 months after their discharge from the hospital. In general 132 men were returned as fit for general service or likely to be fit within three months; 108 actually performed full duty; 140 men were returned in light duty categories; 109 actually performed light duty. Forty-five of the whole number have been discharged permanently unfit.

Of the 558 unselected cases, 15 per cent passed overseas on full duty within eleven months of leaving hospital. The actual figure for the 262 men returned to duty is 30 per cent. Of the men discharged as permanently unfit the condition of 97 is known an average of 8.6 months after their discharge; 89 are occupied, and 7 unoccupied; of the 89 in occupations the average number of

[6] The high percentage of discharge (51 per cent) was due to the fact that at that time there were no sedentary classes; at least half of these men would now be sent out in category 3, *i. e.*, sedentary military employment.

hours of work per day is 7.3. A comparison of the occupations before and after serving is illuminating and of importance in relationship to the question of pensioning. In the men originally in light occupations, there is displayed little decrease in their capacity for work, the men returning to their former occupations. But those formerly doing heavy or moderately heavy work were forced to seek moderately heavy or light work; their capacity for work and wage-earning was reduced.

The practical value of using the principles of graduated exercises as a method of categorization, of therapy, and as an equitable basis for pensioning is apparent from these results. A soldier who can perform a 30-minute exercise, and take a 3 to 4 mile route march with practically no symptoms, is usually able to carry on in full duty category. These who stand less are categorized in correspondingly lower grades. Therapeutically the method is also of value, the physical health of the soldiers improving coincidently with their ability to stand the more severe exercises.

We would emphasize the importance of *prophylactic measures* in limiting the number of cases of N. C. A. in the American forces, and offer the following suggestions tentatively in this connection. Since approximately half of the soldiers subsequently invalided for N. C. A. have had symptoms before enlistment, measures of prophylaxis should obviously be applied by the examining boards of the new National Army and by the medical officers at the training camps. Very careful histories of exercise tolerance and objective evidence of this tolerance should be obtained. The possible cases of N. C. A. will fall into several groups, depending upon their severity. The very severe, and possibly the moderately severe, ones are unfit for any continuous first line duy. They had better be left in their civilian occupations, especially when such occupations are of service to the Government. In the mild types of this disorder a more gradual physical training would fit many for active service Provision should be made at the training camps for the recognition and proper disposal of those cases of N. C. A. either passed by the examining boards or developing at the camp.

The infectious group comprises a large part of the remainder of the cases of N. C. A. These follow acute infectious diseases, such as trench and rheumatic fever, influenza, etc. A longer period of convalescence and a system of more gradual hardening before return to full duty would limit the number of such cases. The remainder of the cases of N. C. A. follow gassing, shell-shock, burial and prolonged strain; for this group there are no prac-

ticable prophylactic measures. The above prophylactic measures, if successful, will prevent the transportation overseas of many soldiers with N. C. A.

SUMMARY, CONCLUSIONS, AND SUGGESTIONS

1. An affection known in civilian practice, but greatly exaggerated and very common among soldiers under the present war conditions, has been described and a new name for it, Neuro-Circulatory Asthenia, is suggested.

2. The method of dealing with this large group of cases by the British Army has been described, and its value in sorting, in therapy, in reducing hospital staff by half, and in establishing an equitable basis for pensioning has been sufficiently proven to recommend that the United States Government adopt a similar plan should the same disorder become prevalent among the American forces.

3. All medical officers of the American forces should learn to recognize the clinical picture of this syndrome, and a certain selected number should have the opportunity of studying such cases and of learning by actual experience to employ a system of graduated exercises as a therapeutic measure and as an aid to categorization.

4. To limit the occurrence of this disorder in a prophylactic way it is suggested that—

(*a*) Measures be taken for the *early* recognition of cases of N. C. A., *i. e.*, at the time men are called to service and at the training camps.

(*b*) Men who are seen to flag or show signs of breathlessness by their drill instructors should be reported to the medical officer and thoroughly overhauled from the point of view of this syndrome at an early date.

(*c*) The period of convalescence after infectious diseases be made sufficiently long, and, after complete recovery, the soldiers be gradually hardened before returning to full duty.

5. It is strongly recommended, above all, not to transport soldiers suffering from this disorder overseas for active service, as it is now known that their period of service on full duty is short.

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INTERNATIONAL SURGICAL SOCIETY

Dr. W. W. Keen writes: I have been requested—and join personally in the request—that you will kindly publish the following resolutions:

"It was agreed at a meeting held in Paris on November 3, 1917, of delegates of the International Surgical Society from Belgium, France, Great Britain, Serbia and the United States of America, that:

1. The International Surgical Society be dissolved after the publication of the Volume of Transactions of the meeting held at New York City, April 14, 1917. Should any money remain after the publication of the volume, such money will be divided pro rata among members. Each member of the Austro-German group will receive his share; but the money belonging to members from other nations will be retained and applied to some object of scientific reparation in Belgium.

2. A new society will be created after the war on a similar basis, to be called the "Inter-Allied Surgical Society." Surgeons of neutral countries may also be elected members."

MALINGERING IN U. S. TROOPS, HOME FORCES, 1917[1]

THE OFFICE OF THE SURGEON GENERAL, U. S. ARMY

(Concluded)

(With three illustrations)

Symptomatic Grouping.—A multiplex symptomatology has always been characteristic of malingering. A man who fabricates or elaborates illness seldom confines himself to a single complaint. A number of cases have been observed in the present mobilization in which men have been brought to the base hospital on stretchers, alleging blindness, deafness, and paralysis, who, when it was shown that they were suffering from none of these, have, in response to a command or a threat, picked themselves up and walked to their quarters. One man appeared twice before an examining board with a variety of complaints not borne out by his robust appearance. He described himself as an epileptic, suffering from catarrh, kidney trouble, and unable to stand the hot sun. He whiningly complained that the local board treated him unfairly. One man from Georgia, after the draft numbers were called, passed from one physician to another to be examined for physical defects as a device for escaping the draft. He was noted on a local board as malingering defective vision. Then he claimed to be syphilitic by reason of a congenital perforation of the septum. It was afterwards found that he had been coached by a quack physician and had taken cantharides to produce albumen in the urine to create the impression of nephritis. He was finally exempted for flat feet. Many are extremely persistent, and, in the event of their being laughed or shamed out of one complaint, reappear in a few days, complaining of something new. Exaggeration is another classical symptom. All complaints are described in superlative degree, no matter how slight the basis for them may be. Suggestibility induces the malingerer, at the first sign of sympathy, to be led on to make the most contradictory statements and to claim additional disabilities to those for which he first sought discharge. The expansive malingerer is inclined to be general in his statements, to advance the most trivial accidents or diseases as causes of the disability for which he seeks exemption, and to show himself over-anxious to impress the examiner with the serious character of his complaints.

It is readily seen that it would be difficult or impossible to formulate any exact estimate of the ratios of the comparative incidence of the different clinical forms of malingering. The complaints so frequently cover a variety of diseases that the reports of different medical officers

[1]Bulletin compiled from the reports of medical officers by Lieut. Col. Pearce Bailey, M. R. C., U. S. Army.

with diverse professional leanings cannot be expected to furnish accurate information on this point. For example, while the views of medical officers are practically unanimous concerning the mental inferiority of persistent malingerers, other conditions are reported as being more frequent than the mental. There seems to be, however, a general agreement that eye and ear conditions comprise about one-half of the total. At Camp Logan, 28 cases comprised: General symptoms, 21; eye, 6; ear, 1. At another camp this ratio was given: Special senses, 8; nervous and mental, 5; all others, 3. At still another camp it was estimated that disturbances of hearing and vision embraced the complaints of 50 per cent of all malingerers, stiff and painful joints 20 per cent, flat foot and other foot conditions 10 per cent; the remaining 20 per cent was covered by hernia, pain from old fractures, old syphilis and recent syphilis intentionally left untreated until after the examination, heart disease, nervous troubles, but no feigned insanity, with possibly one exception.

Some clue as to relative frequency of the various classes of cases may be gained from a study of the total disabilities for which recruits have been rejected. It is reasonable to suppose that the most frequent instances of malingering will be found in those clinical groups in which rejection is most frequent. In the report of the Provost Marshal General on the operation of the selective draft law are given the preliminary figures as to approximately 10,000 rejections drawn from eight camps. These show the most frequent causes for rejection to be as follows: Eyes, 21.68 per cent; nervous and mental, including mental deficiency, alcoholism and drug addiction, 9.07 per cent. From this estimate it would seem that the greater number of malingerers would be found in these two classes.

It would be impossible also to draw any hard and fast line between the various clinical types. The following grouping is arranged in approximate order of frequency tentatively, and is based on the reports from cantonments and recruit depot posts:

Disturbances of vision. Eye conditions.
Disturbances of hearing. Ear conditions.
General medical.
General surgical.
Nervous and mental conditions (as such).
Fictitious conditions—including wounds.
Bed wetting.

Conscientious objectors.

Disturbances of Vision—Eye Conditions.—Malingerers who wish to avoid military service through feigning impairment of vision, may be divided into two classes: (1) Those who claim a total loss of vision in one

eye. (2) Those who claim a partial loss of vision in one or both eyes. Either group may have a normal acuity of vision, or may exaggerate a defect actually present.

In civil life, feigning of blindness in both eyes is not uncommon, but this is rarely met with in military experience, probably for the reason that blind persons are well known in their own community.

Refusal to read the test card is a favorite method of those who feign or exaggerate visual defects. Some of the men in this class actually have defects that would disqualify them. Others have a slight refractive error, or they have become familiar with the methods of testing with the types, while some have been coached to read only a certain amount. Frequently recruits will give long descriptions of injuries to the eyes, or of foreign bodies in them, and when subjected to an ophthalmoscopic examination they will wink rapidly, turn their heads from side to side, and bitterly complain of the pain caused by the small light in the ophthalmoscope, even when held some distance from the eye. Quite a number deliberately close their eyes, declaring they cannot open them. Rarely do they feign complete blindness, but on inquiry it will be found that they have been able to follow an avocation and that they walked unaided to the place where the examinations were held.

In addition to feigning failure of vision, occasional diseases of the lids will be claimed, which, upon investigation, will prove to be either an irritation induced by placing an irritating substance in the eye, or by partial loss of vision through the use of atropin or other drug, which temporarily suspends the power of accommodation.

As a matter of experience, a recruit with a serious inflammatory disease which might jeopardize his sight practically never exaggerates the symptoms, while the effects of slight chronic conditions, like scars in the cornea or a refractive error, neither of which would reduce the vision below the required standard, will be grossly exaggerated.

Men with inactive trachoma sometimes call attention to their years of eye trouble and describe the treatment they received at well-known eye hospitals, often supplementing their complaints by letters and certificates.

At Camp Sherman malingerers are classified as follows: (1) Cases of normal, or nearly normal vision in one eye, with total or nearly total loss of vision in the other. (2) Cases that claimed defect of at least 20/100 in one eye, and 20/40 or better in the other. (3) Cases in which each eye falls below the requirements. (4) Excessive blepharospasm or other symptoms that prevent the use of eyes for duty.

Detection and Management.—The first class of cases can usually be detected by the "Trial frame test" (Regulation Class *B*—test *b*). The

second class is frequently detected by the mirror test (Regulation Class *B*—test *a*). The third class is usually the most difficult to handle because it includes the pretender who has studied the subject and obtained from his fellow-soldiers all the information possible regarding the methods of testing. He is accepted, however, in the absence of objective evidence, and when the use of the retinoscope reveals no refractive error sufficient to account for the visual defects. Cases in class four are usually put in the hospital and watched.

Irritated lids recover under soothing lotions. Blepharospasm recovers under strict diet, unpleasant internal treatment, confinement in bed, use of bandages, or in rare cases by preparation for operation. A more unusual form occurred in a case at Camp Sherman when the man claimed to be unable to open his eyes sufficiently to permit of examination because of the pain produced by the light. He was ordered to wait until he would submit to examination. He stood for three hours endeavoring to keep his eyes turned down. At the end of this time his nerves broke and he submitted to an ophthalmoscopic examination which was followed by reading the 20/20 line with each eye. His vision at the first test in the right eye was 20/100, and, in the left eye, light perception.

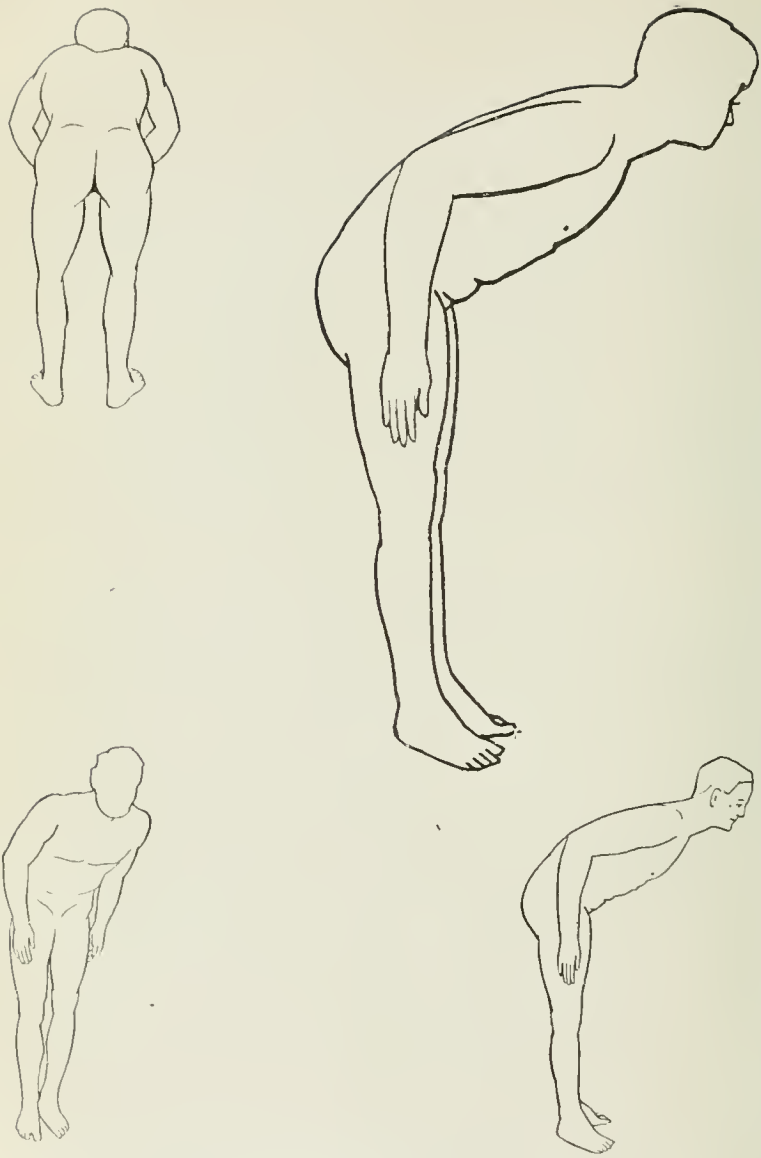
It is impossible to formulate a set of rules that will enable the examiner in a routine manner to detect malingerers; such rules, for instance, as are formulated for the estimation of the error of refraction. In one case we have a definite condition which, when properly corrected, can be checked. On the other hand, the malingerer has at best only an imaginary defect, the proof of which rests in a trial of wits rather than a scientific examination. The examiner soon learns to observe carefully the manner, attitude and general bearing of every recruit presenting himself for examination.

In the use of test cards, it is the greatest advantage to have but one line exposed at a time, and the letters should never be larger than the one required to pass the candidate; or, if only the regular card is available, a hole may be made in a piece of cardboard sufficient to expose one letter at a time. In this way the recruit will be unable to tell on which line he is reading. In using the test card, particularly for illiterates, it is well to insist that some answer be given as to the direction in which the letter points. Occasionally a man will get a whole line wrong, but will through lack of inventiveness give the direction in each case exactly opposite to the true direction. This is very strong proof that he is seeing correctly. Similarly, if, when testing with a coin, he gets heads for tails and tails for heads every time, it is just conclusive proof that he sees, as if he answered correctly each time. Other corroborative evidence makes the decision more easy.

Camptocormia (After Sonques and Rosanoff)
Attitudes brought about by contractures of the muscles of the back in French soldiers who had "shell shock."

Contractures of Muscles of the Back.
Showing (1) forward and lateral attitudes and (2) five cases at Camp Pike in which the recruits all straightened out under a general anesthetic.

(To face page 430,)



Attitudes brought about by contractures of the muscles of the back in French soldiers with "shell shock."

Much can be done by suggestion. Thus, a man will perhaps at first read the largest letters, but later with some sympathetic encouragement he will claim to be able to count figures at 10 feet. Later, if asked if he can see your hand, he will be uncertain, and when told to point at your face (which even a blind man could do guided by your voice), he will point far to one side. If then he is told, "That will do, you may go," he will turn without hesitation, grasp the handle and open the door, though he has probably not used that door before. On the other hand, while a kind attitude is best for some, others need a sharp command and stern manner.

Since the object in examining a malingerer is to prove that he is not honest in his answers, careful testing at different distances will bring out discrepancies in the visual acuity too great to be accounted for in any other way than by a deliberate attempt to mislead the examiner. This method also helps one to determine whether or not a man is willing to do his best. The use of a stenopaic hole will greatly improve vision when the defect is solely one of refractive error. This device is helpful as a quick way to eliminate a large part of the refractive error, and if the vision does not correspondingly improve when the ophthalmoscope shows the presence of refractive error and the absence of other defects, a strong case is at once made against the recruit. It is a short way of reaching the same results as are obtained by determining the refractive error by the use of the retinoscope, then placing the correction before the man's eyes and observing whether or not the improvement is commensurate with the usual gain. Occasionally great interest will be manifested in the records that are being made, and it is not unusual to have an applicant caught in the act of reading a card which he could not do were his vision as tested on the distant card. In the most illiterate cases, it sometimes becomes necessary to rely entirely on ophthalmoscopic examination. Only by a complete examination of the eyes, including opthalmoscopy, can all possible causes that might result in such diminution of vision as is claimed, be eliminated.

It is not always easy, sometimes impossible, to ascertain the acuteness of vision because of lack of knowledge on the part of the recruit to understand or read letters or numerals correctly.

In this type, however, the efforts of the malingerer are manifestly crude. With some, it is evident that they have been coached, as they insist that they can see only the top line on the card, no matter at what distance it is placed. For this type the mirror test will offer means of detection, as usually they will read the same line on the card in the mirror as on the one directly in front of them, which is only one-half the distance. The "illiterate card"—a series of letter "E's" pointing in

different directions—will sometimes so interest the recruit that he loses control of himself and will tell in which direction the letters point on lines much below the one he refused to see on the regular card.

At one of the camps, objects approximating the size of the letters required to be read at different distances have been employed with good effect. The examiner walks 20 feet away from the patient, after having adjusted a trial frame before the eyes containing a plus six spherical lens before the seeing eye, and a plain glass before the "Blind" eye. When 20 feet away the examiner will take a cigarette out of his pocket and ask, "Do you see these?" The answer frequently is, "I do" or "I do not smoke cigarettes." This test is given the value of about 20/100. Holding a lead pencil in one hand and a fountain pen in another exposing about one inch of each, he is asked, "Which do you prefer to write with?" The answer almost invariably is, "The lead pencil." This is equivalent to about 20/40. Holding a match in one hand and asking, "Have you one? I haven't any more," the answer will be, "I have," or, "I have no matches." This is recorded as 20/20.

At another camp, the examiner drove very small nails into the wall about 6 feet from the floor, and when the recruits entered they were asked to hang their hats on the nails, which could not have been seen had their vision been better than 20/100.

Another device to be used for the illiterates is to have some small broken lines on the floor which correspond to the size of the letters for 20/100 vision. A man is asked to toe the line, and if he sees enough to do so correctly, he is caught malingering at his first test.

While it is true that there is a usually peculiar attitude of malingerers which can be easily detected, great care should be exercised lest a serious error should be made and the recruit done a great injustice. The mental attitude of one being drafted into the army is frequently such as to give him a hesitating and embarrassed manner which may appear assumed, and the applicant with a real defect that would disqualify him is suspected of malingering. One should not be adjudged a malingerer until, by thorough examination, all possible causes that might produce the symptoms feigned have been eliminated.

In classifying malingerers, it is important to so define malingering that there can be no misunderstanding. It is one thing to include all those who feign any loss of vision, even though it is not below the required amount for exemption, and quite another matter to include only those who feign a loss of vision below the required visual standard for service. In the first instance, the total number of malingerers in a given number of examination would be included, while, in the latter case, only those whose vision is so low as to cause exemption would be

included. In making reports, the classification should be made distinct.

While the tests given above will be of value in certain cases of malingering, especially in those occurring among the less educated, most cases will require for their detection the application of one or more of the following regulation tests.

Visual Tests for the Detection of Malingerers.—Malingerers who wish to evade military service by feigning impairment of vision may be divided into two classes as follows: (*A*) Those who claim total loss of vision in one eye. (*B*) Those who claim partial loss of vision of one or both eyes. Either group may have a normal acuity of vision or may exaggerate a defect actually present.

In testing for malingering the medical examiner should bear in mind that detection is more likely to result when the man is allowed to believe that his case is regarded from the first to be genuine and that his story is not discredited. There is something indefinable in the bearing of the malingerer which experience alone can detect. He may be self-assertive and over-confident; he may be hesitating or evasive. Careful observation should be made of his conduct and every movement noted. The nature of the man's answer should be taken into account and considered in the light of the kind of reply given when a genuine refraction case is being dealt with.

Equipment.—The following equipment will be supplied:

(*a*) Trial frame; 1 blank; spherical lenses, +16, +3, +0.25, −3, −2, −1, −0.25 (to be found in regular medical corps equipment).

(*b*) Two prisms, one 6°, one 10° (in regular equipment).

(*c*) Ophthalmoscope (electric battery in handle).

(*d*) Condensing lens.

(*e*) Loupe.

(*f*) Red and green letters on glass: (1) letters varying in size; (2) spectacle frame containing red and green glasses.

(*g*) Special test cards, one and duplicate, with letters reversed to use with a mirror.

(*h*) Mirror large enough to reflect test card.

(*i*) One stereoscope with special cards.

(*j*) Retinoscope (electric, with battery in handle).

(*k*) Ruler, about one and one-quarter inches wide.

Methods of Examination.—Class A: Total loss of vision in one eye.

(*a*) A 6° prism is placed base downward before the admittedly sound eye, while the man looks at a distant light or candle; if he sees two candles, binocular vision is proved. The examiner may vary the test by placing the prism before the "blind" eye, either base up or base down.

(*b*) A prism of 10°, with base outward, is placed before the "blind" eye. If there is any sight in this eye, double vision will be produced, and the eye will be seen to move inward to correct it and fuse the two images.

(*c*) The alleged "blind" eye is covered. A prism of 10°, with the apex up, is placed before the seeing eye in such a position that its edge lies horizontally across the center of the pupil. This produces monocular diplopia. The prism is then moved upward so as to be completely in front of the good eye, and at the same time the "blind" eye uncovered. If diplopia is produced or admitted, there is sight in the "blind" eye.

(*d*) Test with colored glasses and letters: This consists in directing the individual to read a row of red and green letters through a red and green glass. The red letters will be invisible to the eye that has the green glass before it and *vice versa*, but if all the letters are correctly read, irrespective of their color, there must be sight in the "blind" eye. Further, the smallest letters correspond with the 20/40 test letters, and if read at 20 feet, indicate vision up to standard. To determine this, reverse the glasses and direct the letters to be read. As these letters are seen by transmitted light, the proper illumination back of the chart must be observed.

(*e*) Test with trial glasses: A high plus glass is placed before the good eye and a low plus or minus before the "blind" eye. If the distant type is read, the vision in the "blind" eye is good.

(*f*) The stereoscopic test: This may be made with ordinary stereoscope, the printed matter so arranged that certain portions of it are not present before one eye.

(*g*) The bar test: Interpose a ruler about 1¼ inches wide vertically midway between the two eyes at about 4 to 5 inches distant; direct the man to read from a printed page with lines at least 4 inches long. If able to read the lines, binocular vision exists.

(*h*) The action of the pupil must be carefully tested, there usually being no movement to light stimulation when the eye is blind.

If the examiner is not satisfied, the following examination should be made:

(*a*) Oblique examination: A careful examination of the cornea should be made with the aid of a condensing lens and loupe.

(*b*) Ophthalmoscopic examination: A searching examination with the ophthalmoscope should be made, together with an estimation of the refractive error. The pupil should be dilated if necessary.

Class B. Partial Loss of Vision in One or Both Eyes.—Men pleading this disability may be divided into two classes: (1) Those who pretend to have a visual defect. (2) Those who are aware that they have a visual defect and exaggerate its effect.

No hard and fast tests can be prescribed for the detection of these cases. Much depends upon the alertness and ingenuity of the medical examiner.

The tests with prisms are not applicable here, for there is not pretended blindness in one eye, but simply an alleged diminution of visual acuity.

(*a*) Mirror tests with special test cards (see equipment No. 7): Test cards are used which are identical, one having the letters reversed. The recruit is directed to read the letters on the chart across the room, and then in a mirror beside it, which reflects reverse letters that are placed over his head. The letters seen in the mirror are located double the distance of the direct letters from the man examined. The malingerer is apt to read in the mirror the line which he read on the first card, showing that his vision is twice as good as he pretends.

(*b*) Trial frame test: Place a trial frame upon the man's face and put before the sound eye a high convex lens (+16D), and before the "blind" eye a plane or weak lens (+0.25), which will not interfere with vision. If letters placed at a distance of 20 feet are read, the fraud is at once exposed.

(*c*) Oblique examination with condensing lens and loupe to determine corneal or lenticular opacities.

(*d*) Ophthalmoscopic examination: It is probable that the malingerer will resist the ophthalmoscopic examination by frequent winking or rolling of the eyes. In this event, it is best to caution the man that a report of his vision must be made, and then to postpone further examination until after the next few recruits have been examined.

(*e*) Estimate the refractive error with the use of the ophthalmoscope. If no error of marked degree exists, and the media and fundi are normal, the relation between the alleged vision and the refractive condition furnishes an important clue. If the error is about +4.00 or −2.00, the visual acuity could be about 20/100, but when the defect cannot be accounted for objectively and the vision is brought from 20/100 to 20/50 or 20/30 by means of a low plus or minus glass, the man is malingering.

(*f*) Retinoscopy: Look for corneal and lenticular opacities and estimate refractive errors.

Occupation: The man's occupation in civil life may have been such that it could not have been followed without more vision than he claims.

In the absence of ocular defects, continuous and persistent blepharospasm, the use of colored glasses, eye shades, or eye bandages should be regarded with suspicion.

Diplopia: Cases of malingering are occasionally met with in which the man complains he sees double. These must be investigated with the application of the ordinary tests as if they were genuine, with every precaution taken to guard against a serious lesion being overlooked.

Disturbances of Hearing—Ear Conditions.—Cases of this character have been chiefly magnifications of slight imperfections of hearing on one side, together with complaints of past troubles, running ears and the like. The exaggeration of defects in hearing extends to declarations of total deafness on the affected side.

A young man of Italian descent feigned absolute deafness persistently at Camp Upton. Rest in bed, combined with moral suasion carried out for two days, proved his ability to hear 20/20 with ease. He afterwards said that his reason for feigning was that if he went to war he would surely be killed. When he left the hospital he did so in a cheerful frame of mind and the surgeon reported there was every reason to believe that he would make a good soldier.

One specialist officer writes:

> Of 318 men especially referred to me for various conditions of their ears, nose and throats, to be passed upon for their fitness for military service, 5.34 per cent were classified as malingerers for hearing.
>
> A few officers have consulted me, making complaints that seemed to have no foundation, seeking to be transferred from one department to another. Among enlisted and drafted men a larger number of cases were observed.

Detection and Management.—(1) In testing malingering, the suspect should be placed in the center of the room free from all obstructions. His eyes should be securely and completely blindfolded.

2. An accurate notation of the deaf ear should be made, and a critical examination of the auditory canal and membrana tympani. Where possible, the patulency of the eustachian tubes should be determined.

3. An accurate testing out of the normal ear should first be established. Care should be taken not to allow the suspect to hear figures or other signs as to result of examination.

4. In making these examinations, the observer should have a skilled assistant, and all communications between them should be in a low whispered voice.

5. The assistant should stand at the back of the patient and should, at the direction of the examiner, obstruct the ears of the suspect as directed, by pressing the tragus firmly into the auditory meatus.

6. If, when the normal ear is tightly plugged, the suspect gives markedly conflicting statements as to the distance at which he hears the voice or acumeter, it is fair to assume he is a malingerer.

7. The simplest and most available test for malingering is an ordi-

nary binaural stethescope. One ear piece, the one to be applied to the normal ear, is packed tightly with a wad of absorbent cotton and the ear pieces are placed in the suspect's ears. The examiner speaks in a soft tone or counts into the bell-shaped chest portion of the stethoscope, and the suspect is told to repeat what he hears. The tubes are removed from the ears, and the assistant is told to stop the normal ear. The same words or numerals are again repeated. The suspect will now claim failure to hear the words or numerals which he had previously heard through the tube with the ear stated to be deaf.

8. Erhard's test is another simple method for malingerers which requires no special apparatus. If the external auditory canal of a normal ear is tightly packed with absorbent cotton, it will still conduct sound waves to a limited degree, a loud ticking watch, even under these circumstances, being heard about one or two meters. The ear which is stated to be deaf is stopped and the test is then made with the hearing of the normal ear, the suspect being told to count the click of the watch. The suspect's normal hearing ear is then stopped and the testing is made with the supposed deaf ear. Under this test, if he claims failure to hear the watch under one meter, you may be certain he is malingering.

9. The Chiman-Moos test is made with the C2 tuning fork. The vibrating tuning fork is held at equal distances from each ear. The suspect will claim that he hears it better in the normal ear. The vibrating tuning fork is then placed on the vertex of the skull. The suspect, hearing it equally well in both ears, will at first hesitate, and then state he hears it better in the normal ear. In diseases of the conducting apparatus, as is well known, he should hear it better in the diseased ear. If now the external meatus of the normal ear is tightly closed and the vibrating tuning fork is placed upon the vertex of the skull, an individual with a diseased ear will state he hears it better in the normal closed ear; or it may be impossible for him to decide in which ear he perceives the tone better. The suspect with the normal ear tightly obstructed will state that he does not perceive the sound of the fork when thus placed on the vertex of the skull.

General Medical Conditions.—Among the general medical conditions which must be considered under the heading of malingering are indefinite illnesses which clear up rapidly under hospital treatment. Sore throats, general pains, general disability and the like fall naturally into this class. Cardiac conditions are frequently complained of, chiefly as shortness of breath, feelings of suffocation, palpitation, suffocating attacks, pain around the heart. Tuberculosis is claimed more frequently than other pulmonary conditions. Gastric troubles are frequently complained of and are usually fortified with a long

history of "stomach trouble" commonly backed up with statements to prove how long and how unsuccessfully the patients had been treated for the complaint. Sometimes a history of gastric ulcer is given in such detail that the bismuth and X-ray test has to be employed. Abdominal conditions refer chiefly to pain associated with adhesions due to old operative conditions. Acute appendicitis has been feigned in a number of instances. In one case, parents wired the commanding general requesting that the soldier be allowed to return home for operation. When the request was refused, he resumed drilling, with no recurrence of attacks.

Detection and Management.—The detection of medical cases depends on the absence of positive findings in one who presents the general characteristics of the malingerer. There is especial need for the examination to be thorough in this group. Some of the cardiac cases at first regarded as malingerers were pronounced later by the Cardio-Vascular Board to have mitral stenosis, and similarly proper tests have shown the existence of gastric ulcer in cases which were under suspicion of fraud. The estimation of the reality of rheumatic pains is always a difficult matter. Proposal of operation has often proved a valuable aid in the clearing up of members of this group. Many men after refusing it have gone meekly back to duty in apparently good health.

General Surgical Conditions.—Under this general heading are included various surgical conditions, old scars and injuries of the bones, fractures and orthopedic conditions. The following distribution of diagnoses from a base hospital surgical service, is characteristic. Numbers of the patients are reported as remaining on the surgical service many days, refusing operations, as is to be expected of the malingerer.

	Cases
Gunshot wound possibly inflicted with object of discharge from service	4
Chopped fingers possibly inflicted with object of discharge from service	2
Amputated fingers (hand lain on railway track)	1
Medical (pain in stomach simulating ulcer)	4
Medical (pain over gall bladder or indefinite)	6
Rheumatism, multiple or single arthritis	20
Painful operation scars	3
Post-operative adhesions	10
Varicocele	20
Hernia, mostly inguinal	20
Hernia, post operative	4
Flat feet	60
Old fractures of legs, feet and arms	15

Multiple small painless lipomata	1
Backache	20
Infected foot (mild cases refusing operation)	2

As indicated in the above table, flat feet are among the most frequent complaints of this class. These are extremely troublesome cases. Many men get discharged for this disability, and, in the absence of pronounced abnormalities, it is very difficult to determine whether they are malingerers or not. It should be remembered that many men, such as guides, have flat feet and yet can walk long distances without pain, as indicated in the above table. The motives for malingering or exaggerating flat feet are by no means always for the purpose of avoiding service. In the National Guard Divisions, this complaint is more frequently made to avoid long hikes. Stiff joints are frequently complained of, usually as having taken their origin from a fracture or other injury sustained a long time previously. In the absence of palpable signs of joint injury, and with negative X-ray findings the mobility of these joints can generally be demonstrated, as shown in the following:

Patient brought to the infirmary by his battalion commander with the statement that the man should be discharged on account of a stiff knee that had existed, from the patient's statement, for three years. On examination, could not get his muscles sufficiently relaxed, so an anesthetic was decided on. The preliminary examination of his heart disclosed the organ to be in a very bad condition, and the question as to whether or not ether could be safely administered was freely discussed in his presence. He finally decided to try once more to relax the muscles of his thigh and leg, and did so sufficiently well to demonstrate a perfectly normal knee.

Nervous and Mental.—In spite of the fact that most malingerers belong to the class of psycho-neurotics, few nervous diseases with the exception of epilepsy and paralysis, are chosen by them for copying as such. Convicts frequently feign insanity, but the present recruits, perhaps because all the emphasis is laid on the physical side (physical defects—physical examination), have made practically no effort in this direction at all. With the exception of a few evidently insane men who resorted to some of the sly tricks of the insane, and of rare cases of silly pretense at insanity, such as dangling a wish-bone in a cup to create the impression that the performer believed that he was fishing, feigned mental diseases have not been brought to the attention of medical officers. Mental defect is more frequently feigned. Shrewd illiterates make use of it to deceive company commanders, and foreigners exploiting it through ignorance of the language, make an extra show of stupidity for the purpose of getting out of the service.

Feigned insanity is recognized as such by the failure to produce any clinical type, but especially by the absurd statements or actions of the pretender. In the absence of these data, observation in hospital ward is necessary for detection. Feigned mental defect in illiterates can usually be detected by examination into the man's knowledge of his home environment. It is often necessary for the examiner himself to possess some knowledge of the environmental conditions of the locality from which the man came. The same is true of the foreign tongued, when an interpreter is available. An interpreter is so frequently unavailable that detection of men of this class is often reduced to a matter of observation and opinion.

Organic diseases of the central or peripheral nervous system cannot be copied, and efforts in this direction are limited to certain symptom-groups, such as paralysis, which is never made to correspond with the characteristics and accompaniments of organic paralysis. The symptoms of functional nervous disease, however, are excessively frequent in those who present the general characteristics of malingerers. This constitutes the most difficult problem, as it may be impossible to decide, even after the most painstaking and time-consuming investigation, how much is intentional, and how much is the unconscious production of neurosis, which the man has never been able to control, and for which he cannot be held as fully responsible.

(*a*) *Pain and Hyperasthesia.* The most frequent of all complaints.

Detection and Management.—Failure to correspond in distribution with true clinical types. History often quite inconsistent with type of pain complained of. Absence of the ordinary traces of prolonged pain, and of the other symptoms which usually accompany type of pain complained of. When referred to limited areas, absence of the sharply localized painful points, characteristic of neuralgia. Behavior of patient (when he thinks himself unobserved) to be carefully noted. Sometimes pain comes on suddenly as in the following case:

Man suddenly fell out of ranks while drilling, complaining of terrible pain in his thigh. He was carried back to the infirmary, a distance of 2 miles, by comrades. Pain was evidently so severe that we had difficulty in removing his clothes for an examination. From the severity of the pain, it could hardly be anything less than a fractured femur. Inspection showed no abnormality, nor did any other method of examination, and he was required to stand up. At first he was unable to do so, but on being threatened with arrest, he recovered the complete use of the limb, all pain disappeared, and the man returned to his company, as well able to walk as any man.

(*b*) *Tremor.*—By itself is not a cause of rejection or discharge. Very frequent in early days of training, as a result of the unusual exertions

and fatigue. If accompanied by other symptoms, etiological character of the tremor must be determined in conjunction with them.

(*c*) *Anesthesia.*—When not a symptom of organic disease, it is usually encountered as a loss or diminution of sensibility to touch and pain. Thermoanesthesia rarely feigned. "Human pincushions," or persons who can bear sharp needle pricks, etc. without giving evidence of pain are by no means rare, although some of them cry out when the needle is thrust in unexpectedly. Many neurotic individuals seem to be under the ordinary threshold of sensibility.

Detection and Management.—Complaint of insensibility of the body is of itself indicative of malingering, because genuine patients rarely complain of this symptom, and even hysterias are usually ignorant of its existence. The most reliable means of detection consist in its failure to reproduce the clinical picture of the various diseases in which it occurs, and the faulty association with other symptoms.

(*d*) *Epilepsy.*—This disease, being one of the commonest causes of discharge from the Army, is naturally frequently imitated. Men who have sustained fractures of the skull or other head injuries are very apt to claim they have fits. At Camp Gordon, there were three or four cases in which fits occurred only in the presence of lay witnesses. At Camp Hancock, out of seventy neurological cases, ten patients gave a history of fits and three feigned fits clumsily. The complaints may be in reference to grand or petit mal. The petit mal attacks are spoken of as fainting attacks, and often take place during drills. The grand mal attacks are generally feigned when no physicians are present, although experienced "dummy cluckers" are not so particular in regard to their audience.

Detection and Management.—There is considerable question whether anyone who can and does counterfeit grand mal epileptic attacks can ever be made into a useful soldier or not. Epileptiform convulsions are common symptoms of the graver varieties of hysteria, and it is probable that the greater number of individuals who are sufficiently histrionic to closely simulate grand attacks are victims of a constitutionally implanted and ineradicable neurosis. Nevertheless, cases are frequently reported from the cantonments, as cured by the methods which customarily cure malingering. The two following cases afford an example:

Italian, aged 24 years, having spells of unconsciousness for past three months. Letter from family doctor describing his case as typical grand mal. Had a fit every other night at nearly the same time, while with company. Was placed in regimental infirmary for observation. The first seizure observed was well acted, and very difficult to distinguish from the real disease. Firm pressure on the supraorbital nerve however stopped the convulsion. Patient overheard

the physician planning numerous tests to determine whether or not he was malingering and he did not have any return of the trouble, nor has he for the past ninety days.

Prisoner, aged 25 years. A foreigner who knew but a few words of English, although he had lived in the United States for about five years. He was charged with desertion. It seems that he was told by several fellow-prisoners that he was to be shot at sunrise on a certain day. He was very much frightened and decided to try to obtain sympathy and help by feigning sickness. Some years before he had seen a companion have several epileptic seizures. He knew these were very serious and he thought he could simulate the attacks. He was brought into the hospital in a very violent convulsive seizure. These were continued with short intervals of rest during which he was apparently unconscious and from which he could be aroused by a prick of a pin or some like means. With the help of an interpreter, he was told that the officer knew positively that his illness was assumed and that serious punishment would certainly follow if he continued to do so. His mind was relieved as to the probability of his being shot for his alleged desertion. He immediately recovered and has had no illness since that time.

In cases in which the attacks are not witnessed by a medical officer it is necessary to obtain a verified history of preceding attacks. The attacks of true grand mal generally have certain characteristic symptoms, viz., the pupil does not react to light for a short time after the attack, the Babinski reflex is present and the knee jerks are lost. In simulation the initial cyanosis of the epileptic is wanting and the tongue is rarely bitten. It is said that the frothing at the mouth is reproduced by the simulator filling his mouth beforehand with soap suds.

One surgeon writes:

At one time we were having as many as seven to ten calls a night from company barracks to come and observe a man in some convulsive seizure. If any objective signs could be found to account for his symptoms, he was held for further observation, or if he could show conclusively that he had injured himself in some way from the fall due to the convulsion or sudden onset of unconsciousness, but unless he could do so, some one of the many tests used to detect malingerers was enough to demonstrate that the condition was being feigned.

Hysteria.—This multiform neurosis is not chosen by malingerers, but, more than any other disease, it renders the diagnosis of malingering extremely complicated and difficult. Hysteria makes its victims imitate other diseases, which they have seen or heard about.

At the time that a number of organizations were quarantined for meningitis at Camp Beauregard, a soldier, while at drill, suddenly felt pain in his back and legs, and fell to the ground. He was carried to the infirmary, thighs and legs

flexed, forearms flexed, his back slightly flexed, fists closed, thumbs outside of fingers, and with the fists pressed beneath the lower jaw, eyelids closed, mouth open, face flushed. All the muscles of his body were rigid in continuous contractions. He moaned and groaned, and complained that the slightest motion caused extreme pain. The man had been well previous to the drill, and, from the time he dropped in the ranks until brought to the hospital, probably ten minutes had elapsed. The manifestations were so distinctly irregular, and not characteristic of any disease that the writer felt justified in speaking sharply and loudly to the man, ordering him to "get up immediately and stop his damn foolishness." This was accompanied by a sharp rap with the palm of the hand upon the patient's abdomen, and upon the forehead. The man did get up and was permitted to sit in the infirmary for half an hour. He was then returned to duty and walked to his company street unassisted. There has been no further convulsion or spasm in his case.

This might have happened in civil life, where it would have been called hysteria, but happening in the Army the soldier is immediately suspected of malingering. The fact that hysteria presents the same symptoms in the Army and out of it should be remembered by all medical officers. The military situation may sometimes overemphasize the apparent motive. The symptoms of hysteria never reproduce those of organic disease exactly, but they come closer to it than is possible to any conscious simulator, and whenever there is a reasonable doubt as to whether a man is really pretending or not, the chances are that a hysterical element is strongly represented in the case. This does not mean that all hysterics should be eliminated from the Army. On the contrary it is probable that more of them can be converted into reasonably good soldiers than men who dishonestly try for discharge.

The two instances where the question will come up most frequently are cases of paralysis and of contractures of the muscles of the back.

Paralysis.—There have been a large number of cases in which recruits alleged that they could not walk or use one arm, or complained of other symptoms suggestive of paralysis. In many of them counter suggestion was followed by a rapid disappearance of the symptom complained of.

Detection and Management.—The first thing to be established is to determine whether the paralysis is real or not. In cases in which the joint has been held immovable for some time, this may be a difficult matter. But by the employment of the faradic current, by observing the type of the symptoms and the way they are associated together, organic paralysis, either peripheral or central, can usually be proved or disproved. The only question remaining is whether it is feigned or hysterical. If careful inquiry brings to light, as in most cases it will, other causes than those immediately connected with a wish to evade ser-

vice or duty, the element of hysteria may be considered as demonstrated. Under these circumstances, after a reasonable amount of reassurance and explanation, the recruit should be returned to duty. Cases of hysteria in which the physical symptoms are most prominent are often the easiest to cure; and it is believed that many of them, after their paralysis disappears, will turn out good soldiers.

Contractures of the muscles of the back, "Guard house back" Camptocormia: This condition, in which the back is held stiffly forward or laterally, is frequent in our Army and has been frequently mentioned among French soldiers. It is generally regarded as midway between malingering and hysteria (see Figs. 1, 2, and 3).

Detection and Management.—It is first of all necessary to be sure of the absence of disease of the vertebrae, for which X-ray examination may be necessary. Usually, however, the attitude is more bizarre than any caused by organic disease, and the history of the development contradicts such an assumption. Careful inquiry will generally elicit the information that the deformity is associated with the belief on the man's part that he has an actual disease of the spine or kidneys.

These cases often clear up rapidly under the usual methods employed for hysterio-malingerers. The commanding officers of a general hospital report the case of a man who claimed to have a rigid spine in the flexed position. Placed on the floor prone he retained the flexed position until his muscles tired, when his spine straightened out so rapidly as to bump his head. Five exaggerated cases at Camp Pike were straightened out after a single etherization.

The following illustrates their conditions (Figs. 1-3):

A Greek assumed a crouching attitude in walking. History shows attitude was assumed a short time prior to arrival.

Object: To avoid service.

Detected during sleep, when it was noticed he had perfect extension of lower extremity; various remedial measures, resorted to without avail; finally placed in a room in mental ward, with a restless and talkative insane patient, which resulted in his complete recovery; now in ranks and drills every day; he volunteers no explanation of his conduct.

An Austrian, in various wards of base hospital, walks about with stooped shoulders, right hand over left chest, much emaciated, distinct apathetic expression; claims to have "heart trouble," to suffer "heart pain;" examination discloses normal heart, sound outline and action; placed in cold pack for three successive days; a complete transformation effected; expressed a desire to go to drill and return to ranks; volunteers no explanation for conduct. At present in ranks drilling regularly

Alcoholism and Drug Addiction.—As mentioned elsewhere, alcoholism is concealed at recruit depots for the purpose of obtaining service. As

for drug addicts, in contrast to the large numbers of them in the civil population, mentions of drug addiction in the present mobilization have been strangely few. Only a small number of cases have been reported from the camps in connection with malingering, although it was rumored at the time of the first draft that many young men were beginning to take drugs with the idea of being exempted. It is possible that a considerable traffic in habit-forming drugs at the cantonments is being carried on at the camps.

There have been a number of instances in which individuals have claimed to be drug addicts, stating that they had been taking large quantities of morphine, heroin or cocaine; but when placed in the hospital with every precaution taken to see that they get no drugs, they showed absolutely no deprivation phenomena. At Camp Sherman, two men had hypodermic syringes and tablets of morphine in their possession. Admitted to the hospital at 8 p. m., each demanded morphine. They were given hypodermics of sterile water and slept all night. Next morning, confronted with the facts, they both confessed never to have taken morphine in their lives. Others have made needle punctures in their arms with the intent to create the appearance of long drug taking.

Detection and Management.—In confirmed takers of opium or its derivatives, the symptoms which result from abstinence, consisting of pains in the back, and legs, diarrhea, extreme restlessness and sleeplessness, are inevitable and unmistakable and constitute the one certain means of diagnosis. The individual who claims to have taken opium for months and does not present the above symptoms when cut off is not telling the truth. Some who snuff heroin have no needle marks. But the confirmed habitué carries with him the scars of old and generally infected needle punctures. Syringes are improvised by attaching hypodermic needles to medicine droppers.

Fictitious or Artificially Created Conditions.—Gunshot wounds have been more frequent than any other form of injury, after which come cutting injuries. In many camps no cases of this character are reported, but in others six or seven—rarely more—have occurred. In a number of cases amputation of fingers or toes has resulted from the soldier being caught under electric or steam cars. There have generally been no witnesses to the accidents, and when there have been witnesses and they have testified, their testimony has been conflicting. In no case contained in these reports has it been possible to prove that the injury was inflicted intentionally. But there is considerable evidence, in support of the surgeon's almost universal belief that these injuries were self-inflicted for the purpose of securing discharge from the service.

They occur while the soldier is absent from duty, with or without leave. They are nearly always on the right side, and in the case of amputations, are limited to one phalanx or one digit. In many instances the general attitude of the man had been that of dissatisfaction. Self-inflicted wounds are the most serious of this whole class. One man on bridge guard duty, remote from surgical aid, shot himself through the thigh with a service rifle, obliterating the femoral vessels for two inches of their length. He died thirty-six hours later from hemorrhage and shock. To the only man who came to his assistance he stated that he inflicted the wound intentionally, not with suicidal intent, but thinking he would injure himself badly enough to be certain of getting out of the service.

The large number of exemptions for defective teeth has caused some to have teeth extracted. A woman wrote to the surgeon of a recruit depot post that her husband had paid a cheap dentist to pull out all his teeth, because he wanted to apply for enlistment and be rejected. She requested that he be taken into the Army because he was "a lazy loafer and no good at home."

Retention of urine is occasionally simulated. Soldiers add egg albumen to their urine, and have even been known to inject it into the bladder; they add sugar (generally cane sugar) to urine and take cantharides to create the symptoms of nephritis. Thyroid, digitalis and strophanthus are taken to induce rapid heart action. The skin is irritated by different irritating substances (croton oil) being rubbed on it or even injected under it to create abscesses. One man burned his face with carbolic acid. Various instances are taken to bring about purging (one recruit swallowed a cake of soap), and the manipulations of the thermometer to create the impression of fever are historical. An appearance of haemoptosis is produced by adding blood, either that of animals, or human blood derived by picking the nose or from self-inflicted wounds. Sometimes merely coloring matter is added. Hemoptosis is simulated in a similar way by those who possess the accomplishment of voluntarily vomiting what they swallow. Appearances of intestinal disease are brought about by adding coloring matters and blood to the stools. Tobacco is said to be a favorite means of inducing the appearance of various diseases. Mechanical and chemical irritations are made use of to cause inflammations of practically all the body orifices.

The most difficult of all these fictitious simulations to detect is the jaundice, produced by picric acid which has been frequently noted in French soldiers during the present war. Small doses taken at intervals of ten days or two weeks will produce the appearance of hepatic jaundice. The chemical demonstration of picric acid in the urine is the only certain means of detection.

Apparatus is employed to create the appearance of disease, but its only use in the present mobilization has been to demonstrate the simplicity of those who employed them. Glasses are worn by men with normal eyes, and some arriving on crutches have been seen a day or two later walking naturally without them. Ankles are strapped to give substance to the claim of flat foot, and trusses, brand new and clumsily fitted, are worn when no hernia and sometimes even no varicocele is present. One man wore a urine container which lacked all the ordinary signs of use.

Detection and Management.—In view of the circumstances under which self-inflicted wounds occur it has rarely been possible to prove the motive behind them. It is to be noted that all are inflicted on the right side. In the case of artificial dermatitis and abscesses, the distribution of the inflammation is the chief aid in the diagnosis. Of the other conditions under this heading, observation in hospital shows variation from the ordinary clinical course of disease.

Bed Wetting.—Bed wetting is an occasional symptom in epilepsy (grand mal type, not petit mal), in states of stupor and coma, and in certain diseases of the genito-urinary tract, but it is practically unknown among healthy adults (even convicts) except in such as soldiers and sailors who can make use of it to gain an end. Among these, it is chiefly encountered among the slothful, defective and good-for-nothings, the class which contains the bulk of malingerers. It has always been frequent in armies as it is easy to assume, difficult to detect, and, by reason of its objectionable character, often results in discharge. As the surgeon of a recruit depot post writes, "The number of recently enlisted men claiming disability for bed wetting is larger than ordinarily believed. It is easy to assume and too often accepted by company commanders and unsuspecting physicians." Like other feigned conditions, one case in a company is rapidly followed by the appearance of many others. It is also often cured under the proper handling, rapidly. It occurs more frequently in cold weather. Bed wetters are said to sleep very soundly, and in some an increased secretion of urine has been observed. They nearly all tell the same story of a lifelong complaint, which neither their mothers nor, later, expensive physicians, could check.

Some of the patients complain of pain in the back. Many ask to be examined on account of the ridicule to which they are subjected by companions and noncommissioned officers. Bed wetting is usually intermittent. One recruit said "it never troubled him when he did no work during the day."

The following is the case of a bed wetter who was cured by a threat:

A man who had been wetting the bed at night was brought into the infirmary for examination, by his captain, who wished to know whether the man was a true bed wetter or a fraud. He claimed to have been wetting the bed since childhood, and said that he had never slept with anybody. His captain received a letter from his wife the same morning. She asked that he be exempted because she was in poor health, and needed him at home, stating that he was her sole means of support. The captain then said to him, "You do not mean to tell me that a man of your age has never slept with anyone." He said that he never had. He was then shown the letter from his wife, and made an effort to right himself by saying that he had never slept with her after midnight. He was then told the penalties of deception to the Government at this time and cautioned that if he ever did it again he would have to wash every window in the barracks. His nocturnal enuresis promptly ceased. He now prefers a dry and less fragrant bed.

Detection and Management.—In the absence of disease of the genito-urinary tract, this is essentially an affair of management. It is believed that if it were a thoroughly accepted belief through a camp that bed-wetting would never be counted a cause of discharge, that special duties and special quarters would be provided for those who soiled themselves in this way, then bedwetting would soon cease to be a cause of annoyance. A general order of this kind would probably make it unnecessary to devise special means for the handling of individual cases. For special cases, persuasion, threats and assignment to disagreeable duties seem to have had the greatest success. It is considered highly undesirable to send these cases to base hospitals. If it is thought advisable to have the man waked up every two hours during the night, this procedure is better carried out in a regimental infirmary.

. . . . . .

Conscientious Objectors.—As the courts have decided that no form of religious belief is to be regarded as an evidence of mental unsoundness, and as the conscientious objectors feign no disease, they cannot be classed as malingerers. But inasmuch as they rebel against the requirements of military service, they must receive brief mention in this place. They are pacificists by nature or by religious profession, some of them having reasoned that warfare is not different from murder, without themselves being pledged to any fixed creed. The religious objectors are members of various religious sects, of which the tenets, based on a literal interpretation of the teachings of Christ, forbid them to take part in military operations. The different sects vary in the strictness of their requirements, and individual objectors vary as to what they will do in the Army. Some will accept service in the enlisted Medical Corps, but one man gave up his religion when told he was to be a stretcher-bearer in No Man's Land. The individual objectors are apt to be

foreigners who left their own country for the purpose of avoiding military service, while, in this country, certain localities furnish comparatively large numbers from the same church who are related or connected by marriage—often related by intermarriage. The conscientious objectors have naturally been confined to the National Army. A few have been rejected for physical disability, but slight mention of psychopathic states, except as regards their religious views, has been made. The following shows a table classification of conscientious objectors as observed at Camp Custer.

1. Depot Brigade (Custer) shows following assortment of conscientious objectors:

Church of God: will not drill with rifle; but will wear uniform	2
Menonnites, will not drill with rifle, will wear uniform	4
Seventh Day Adventists—hold Sabbath from Friday sundown to Saturday sundown, will not drill with rifle, will wear uniform	7
Church of the Brethren, will not drill with rifle, will wear uniform	6
Christian Reformed Church, will not drill with rifle, will wear uniform	2
First Reformed Church, will not drill with rifle, will wear uniform	1
Individual Beliefs, will not drill with rifle. or wear uniform	6
Individual Beliefs, will not drill, but will wear uniform	2
Assembly of God, will not drill or wear uniform	2
International Bible Student Association, will not drill or wear uniform	2
Israelite House of David, will not drill or wear uniform	1
Methodist Church, will not drill, but will wear uniform	1
Old Brethren Church, will not drill, will not wear uniform	1
Free Methodist, will not drill, but will wear uniform	1

FOOT STRAPPING

By First Lieutenant DUDLEY J. MORTON

With Comments by Major R. TUNSTALL TAYLOR, *Medical Reserve Corps, U. S. Army*

(With two plates)

THE following method of strapping with adhesive plaster for foot strains, and for pronated and flattened feet, is respectfully submitted to the profession.

Material.—One inch of adhesive plaster (about 3 yards used).

Position.—Knee flexed, foot at right angle to the leg, with some supination and adduction of the forepart. It should be entirely passive, the tendon of the tibialis anticus not standing out, by the effort of the patient to hold the position.

Application—First Strip (Fig. 1).—Starting 2 inches above the internal malleolus, the strip is carried down and across the sole of the foot to the fifth metatarsal which it crosses, with the posterior edge of the strip going over the center of the tuberosity of this bone. It is then brought up over the dorsum (Fig. 2), crossing the instep over the scaphoid, then back toward the upper border of the os calcis, passing a little below the internal malleolus.

As the adhesive is taken around the heel, the os calcis is adducted by the operator and the plaster carried outward just above the upper edge of the posterior process, down and obliquely forward, then inward on the sole just anterior to the inferior tuberosities (Fig. 3), and up over the arch, ending a little anterior to, but overlapping its other end.

Second Strip (Fig. 4).—Begins about half its width posterior to the first strip, and overlaps it until carried over the dorsum, where it converges and overlies the latter across the inner side and around the heel. It is then taken a little more obliquely forward (Fig. 5) to pass exteriorly to the ankle joint, and finished with one and a quarter circular turns (Fig. 6) on a level just above the internal malleolus.

Third Strip (Figs. 7 and 8).—This is applied to the second, which it overlaps by half its width posteriorly as far as the dorsum, then overlies it until approaching the circular turns, which are a half width above the previous one.

For Ankle Sprains.—Apply first two short-stirrup straps to a level 2 inches above the internal malleolus, with the foot at a right angle to the leg and without supination. Then apply strips as described above, but not carried so far forward on the fifth metatarsal (only to the center of the tuberosity). Reinforce with two or more stirrup straps between the second and third strips.

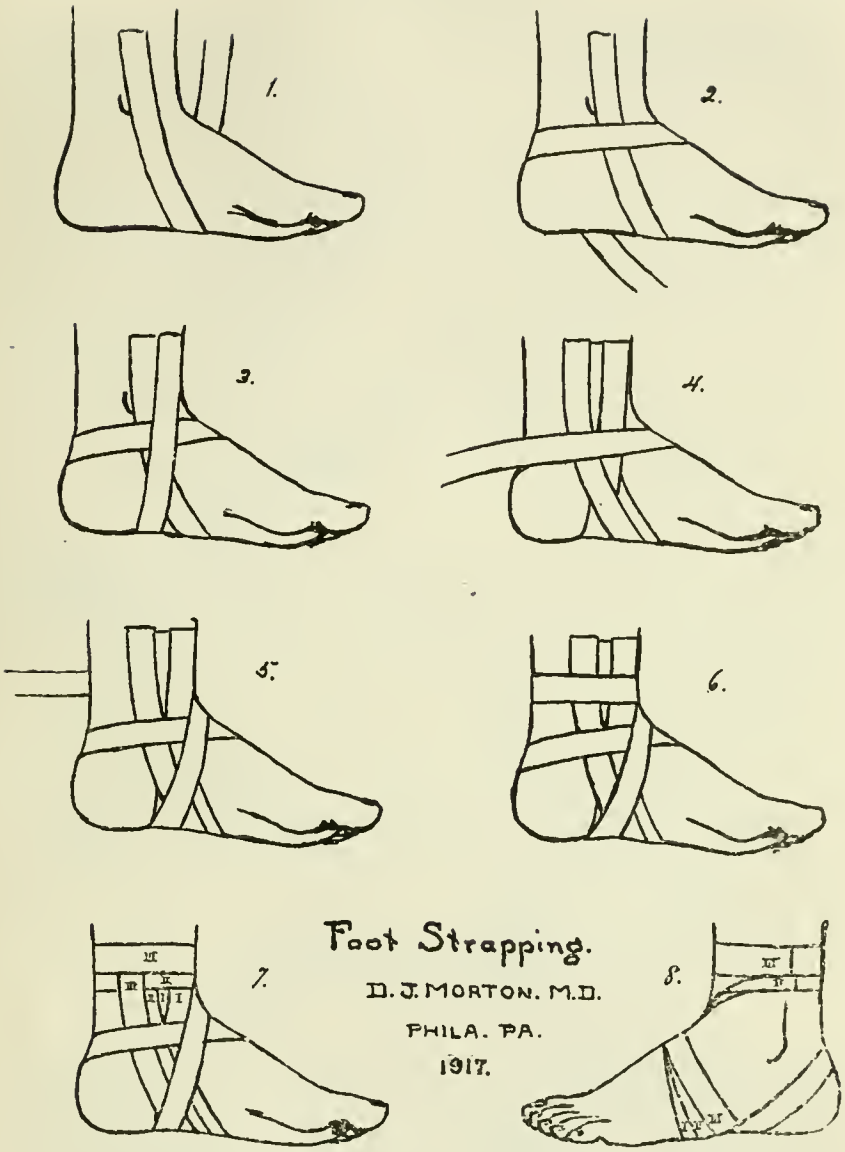


Plate I.

Remarks.—In devising this method of strapping, the mechanics of pronation were very thoroughly considered, *i. e.*, the incursion of the astragalus, especially of the head, the abduction of the heel and forepart of the foot, the inward rotation of the leg bones and the sinking of the arch. It may be noted that by this method the strain-

producing elements are made to antagonize each other. The abduction of the heel and forepart of the foot resists the inward movement of the head of the astragalus by exerting direct pressure upon the area which the head tends to approach when weight is assumed. The inward rotation of the astragalus being prevented, the lateral sides of its tibial and fibular articulation force the leg to move in an arc through the foot and not obliquely across its inner border. The weight is thereby thrown directly into the tarsus. The arch is maintained by a proper apposition of the bones rather than by suspension with strapping on the leg. This method has a further advantage upon the last mentioned one, in that the latter loses its efficiency in a very short time because of the elasticity of the skin and fascia, and by slipping of the plaster on the skin, while with this method anchorage is obtained about bone structures.

Free movements of the ankle in all directions excepting pronation is allowed.

The application is simple, as the contour of the foot throws the strip very naturally into the direction it should go; consequently, wrinkles are easily avoided. There is very little danger of interfering with circulation in this part by circular strapping, as all the important blood vessels lie in bony arches.

Only about one-third the amount of material is required as used in ordinary strapping.

Precautions.—Do not over-correct the foot too much in applying as there is very little give and the correction may prove too severe.

Keep the tendon of the tibialis anticus lax during the application.

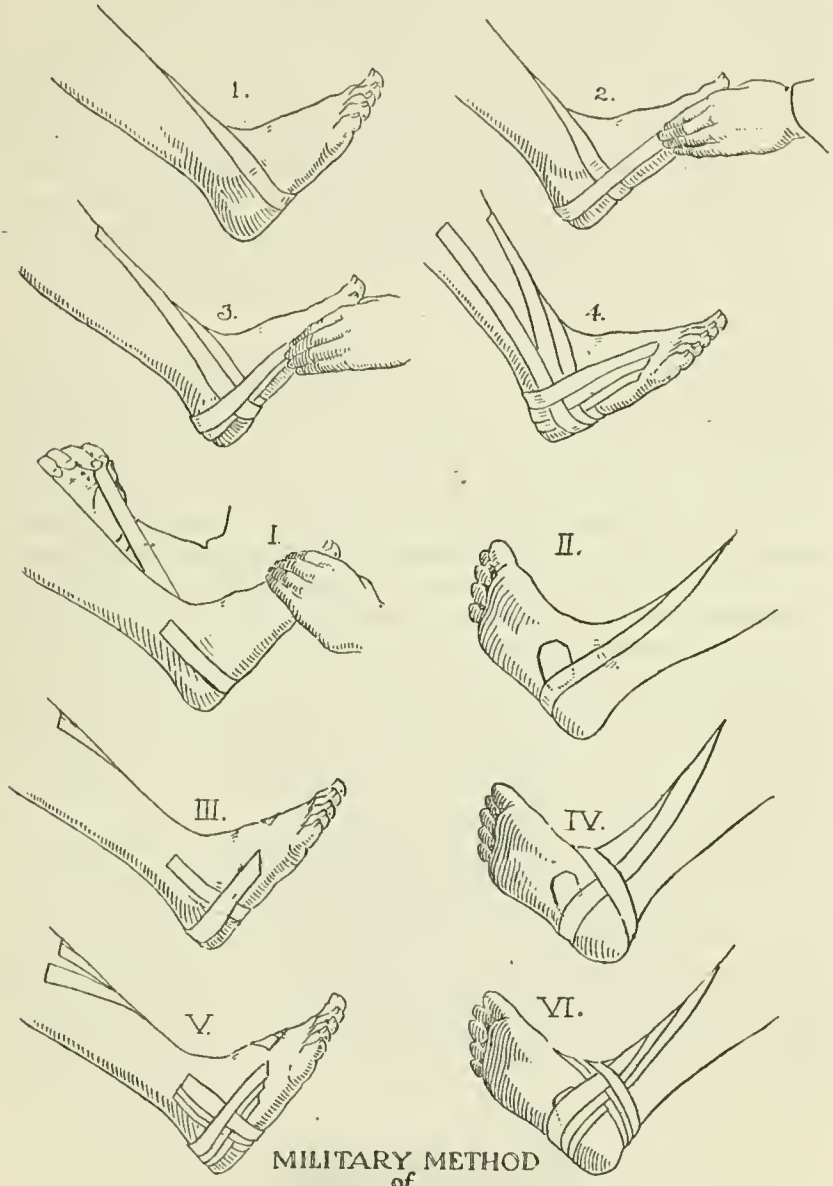
Do not carry the plaster any further forward on the fifth metatarsal than above described.

Do not apply too tightly—an easy tension with the foot in mild over-correction as described is all that is necessary.

COMMENT

In reviewing the article on "Foot Strapping" by Dudley J. Morton, First Lieutenant, M. R. C., the points laid down seem to be good in supporting the astragalus and the scaphoid, but the author is evidently not familiar with the standardized method based upon the concensus of opinion in the American Orthopedic Association, adopted by the Surgeon General's Office, U. S. Army, and published in the Medical War Manual No. 4, Military Orthopedic Surgery, a complete acconnt of which is to be found on pages 35-39. The adopted modification was suggested by Freiberg of Cincinnati. This method is essentially for "foot strain," the straps being (Plate II, Figs. 1, 2, 3 and 4) applied chiefly on the inner side,

whereas, in sprained ankle, they are applied to the outer side of the foot, if the strain happens to be, as is usual, below the external malleolus. (Plate II, Figs. i-vi.)



MILITARY METHOD
of
FOOT-STRAPPING

Plate II.

The chief aim in supporting an over-stretched or torn ligament is that the ends shall be approximated as closely as possible. In "foot strain" we have three elements, usually, to be combatted; (1) the forefoot is abducted, (2) the foot everted, and (3) pronated; therefore, in the application of the standardized straps, the foot is held at a right angle with the leg in supination and abduction. Six straps are employed, each 1 inch wide; three of them are 18 inches long and three of them 12 inches long. The first strap is attached just above the external malleolus, passes under the heel and up over the astragalus and shin. The second strap—one of the 12-inch ones—is attached below the external malleolus and passes around the heel, forward to the dorsum of the great toe, *thereby anchoring the foot in adduction*, which is the key to the relief of foot strain and the prevention of pronation.

The successive layers are superimposed upon these two, overlapping them in a forward or upward direction, as the case may be, about half an inch; the upper ends of the long strips that go up the shin spread out fan-shape, to give greater area of skin attachment and better support. The amount of material used is very small.

The method suggested by Sir Robert Jones to promote primary healing between torn ends of ligaments will prove efficacious, if also used. This consists of a pad composed, preferably, of rolled adhesive of sufficient size and thickness to exert firm pressure at the point where extravasation of blood or serum chiefly occurs, between the torn ends, and is easily determined, as it is the point of extreme tenderness on pressure. The pad, placed at this point, will remove this extravasation to a large extent, promote healing and lessen the frequency of secondary healing or chronic sprains." This supplements the method first described.

The patient is now ambulant, provided the heel of the shoe, of the injured foot, is raised from ⅛ to ¼ inch on the side on which it is desired to relieve the tension—namely, in the case of "foot strain," the so-called "incipient flat foot," the heel on the inner side is raised. In the case of sprained ankle, of the external lateral ligaments, the outside of the heel is raised and the patient can then continue his usual duties. Occasionally it is also necessary to raise the sole of the shoe on the affected side a like amount.

EDITORIAL

MILITARY PROHIBITION PROHIBITS

The Military Surgeon is frequently the recipient of printed matter issued by various liquor organizations, which under a diverse *camouflage* of specious pretexts, is directly intended to promote and expand the profitable sale of alcoholic liquors.

One of the stock assumptions reiterated—parrot-like—throughout this literature is that prohibition does not prohibit. We are supposed to draw the deduction from this that if perfection cannot at once be achieved, improvement should, therefore, not be attempted.

Every now and then this liquor literature harks back to the days of the army canteen; and crocodile tears, ostensibly in behalf of the soldier's health and morals, are copiously shed relative to the abolition of such canteen. But to those of us who have had experience under the canteen system and without it, the falsity, shallowness and cold-blooded selfishness of their argument are evident. Save the day when the liquor interests pose as the guardian angel of the soldier! The canteen of the past, with its relative temperance under military control, was preferable to the unrestricted temptation and vile environment which the liquor interests flaunted in the face of the soldier the moment he stepped off the reservation. But the canteen itself was an evil, though a lesser one. It furnished an opportunity to begin a habit or to fix one, and as such it had the elements of harm. As a lesser evil, however, it was tolerated and supported until the far greater evil, beyond military control, could be removed. The canteen was the first step toward temperance and prohibition. As such it served a useful—though no longer necessary—purpose, for with the establishment of higher standards of temperance in civil life, prohibition in the Army has come to stay.

If this war has proved anything, it is that prohibition in the hands of military authorities can be, and has been, enforced. Since the civil authorities realized that the Army proposed to carry out the extra cantonment zone law against liquor and corruption, alcoholism and its results have practically ceased to be a depressing factor in army health and army discipline. A drunken soldier is rarely seen, and alcoholism assumes a steadily dwindling importance in medical statistics.

The reason why prohibition is a success in the army is because the army enforces the laws under which it operates. Standards in civil life are not so high. Liquor habitues will go to any length to satisfy

their alcoholic cravings, and there are persons so low as to break any law of God or man for the sake of profit. A venal police, winking at bootlegging for a consideration, is not found in the service.

Pro-liquor papers play up the minor defects of prohibition laws to try and demonstrate that they will not be enforced. They merely demonstrate that the alcoholic degenerate which the liquor business creates has developed a drug addiction which is above all fear of law, and that the criminal class to which liquor looks for support may be expected to break the prohibition law, as it breaks those against theft, murder and other crimes.

Alcoholism is not an instinct. It is an addiction and the result of habit. If no opportunity to practice the habit exists, the habit will not be created. Frequent opportunity and attractive environment are necessary to the creation of such habit. An occasional chance amid unattractive surroundings is not enough. Few if any young men become drunkards from the surreptitious tippling of illegitimate whiskey, from a dirty bottle in the hands of the town loafer, down back of the barn.

When prohibition really forces law breaking, it forces it only through the alcoholics who represent a later or finished stage of the rum-sellers' handiwork. The liquor men themselves are responsible for the undermining of society by which the drug addicts they have produced act in opposition to law and honor. They and their trade have brought about this artificial degradation which they now attempt to use in the effort to prove the liquor business inevitable, if not a necessity. Fortunately, the condition is one which time will settle, and that relatively soon. Under prohibition, the class of alcoholics will die out without the liquor interests being able to pervert the younger generation into joining it as barroom customers. And one of the greatest steps to this end is an army in which millions of young men will not taste alcoholics for long periods, and in which the alcoholic habits and cravings so readily established in many susceptible youths will fail of creation through lack of opportunity. After the war is over, sober millions will doff the uniform and go home to vote out the liquor business, unaffected by the iridescence of any cocktail habit or cellular craving for beer soddenness.

The liquor business is an outlaw, disreputable and indefensible, in relation to the army or out of it. There is only one logical argument for it. That argument is one that the liquor interests do not use. It is the argument that the liquor trade is profitable and that those who engage in it—irrespective of human health and morals—need the money. E. L. M.

TEMPORA MUTANTUR, ET NOS MUTAMUR IN ILLIS

The question of varicocele in soldiers has always been anathema to military medical officers. Many a recruit who, before enlistment, never even suspected that his genetalia were anywise abnormal, who never complained of pain in that region and who, so far as that part of his anatomy was concerned, was ready to functionate twenty-four hours daily; after enlistment, recalling remarks made during his physical examination, suddenly developed the most complex symptoms referred to his scrotum, all, except the varicocele, subjective.

The ultimate result was often the discharge of the man on surgeon's certificate of disability, chiefly at solicitation of the company commander, the individual being useless as a soldier.

So serious had this matter become that General Sternberg, then Surgeon General of the Army, referred the question to a board of medical officers, which, after due consideration, recommended that *precedent* to enlistment all noticeable cases of varicocele should be operated upon, or the applicant rejected; and all cases occurring after enlistment should be subjected to operation. The report was embodied in Circular No. 3, S. G. O., 1901.

We do not recall that anything was said of the deleterious effects of a proper operation. Many cases, possibly too many, were operated upon and apparently cured Whether this result was due to the knife or "suggestion" is unimportant, so long as the soldier took and kept his place in the ranks.

Now times have changed, the pendulum has swung to the other side of the clock, and we are in receipt of the subscribed communication, from the Surgeon General of the Army.

To be sure "large" and "troublesome" cover a multitude of varicoceles, and we feel quite certain that there will be fewer "troublesome" cases if the troubled ones know they *must* submit to operation, so we are probably still on safe ground.

It goes without saying that unnecessary operations, in the broad sense of the term, should never be permitted. But should the non-necessity be for the soldier or the service; in a word, what determines the necessity? Are we to discharge a perfectly good man because he has a varicocele and, in consequence, says he cannot do his duty?

If it is accepted that varicocele is a self-limited, non-disqualifying condition, requiring at most a suspensory bandage for its relief; if the medical officer with the case will be sustained in his statement that any soldier who claims he cannot march, ride or perform other military duty because of an alleged pain due to varicocele is, *ipso*

facto, a malingerer and a subject for punishment, then, perhaps, medical officers with troops will be relieved of many troublesome decisions. But they will not be relieved of constant complaint from company commanders because they decline to recommend the discharge of useless men. And yet, if we operate, the man is at once given a pensionable status.

The memo. reads as follows:

Attention is called to an article by Joseph Colt Bloodgood, M.D., in the *Journal of the American Medical Association,* February 9, 1918. Vol. 70, No. 6, page 409, on the operation for varicocele. The Committee on Genito-Urinary and Venereal Diseases feels that it is not wise to operate on most of these cases. It is only when the varicocele is large and troublesome that operation is indicated. Many of these patients are neurasthenic and are suffering from chronic prostatitis and seminal vesiculitis. Their symptoms are not relieved by operation and, as they do not get the expected relief of symptoms, their nervous condition is often worse than before operation.

It is further suggested, as a considerable portion of those operated on for varicocele develop hydrocele, that the operation for hydrocele be done on all cases of varicocele operated on. Retrenchment of the scrotum may be indicated when the cord is much relaxed without the hydrocele operation.

The following extract from a report by Capt. Ernest G. Mark, M. R. C., of Camp Sheridan, Ala., we feel is the attitude to take for the best efficiency of the service:

"The preponderance of cases coming up for operation are those of varicocele, most of which require no operation. It has been the endeavor of this department to apply properly fitting suspensories and to advise in the majority of cases against operation. The attention of the regimental surgeons has been called to this fact through the division surgeon."

February 15, 1918.

FRESH AIR

The subject of ventilation is so familiar to medical officers as to be regarded as elementary, in fact an apology is needed for dwelling upon it at this time, when so many larger problems are before us. But it is a fact that, while we are sufficiently familiar with this subject theoretically, when it comes to the practical application of its simplest principles in camps and barracks, we often seem to lose sight of the vital importance of ventilation to the health and efficiency of a command. The British have learned this after many costly lessons and we shall do well to profit by their experience in this and other directions.

One who has lived in a British training camp and has become familiar with the intensive training, which in ten or twelve weeks transforms a slouching country boy, or a pale-faced, shambling London cockney, into an alert, smart erect young fellow, full of life and "pep," is impressed not only with the rapidity of the transformation, but the way in which it is accomplished. Of course the men are far from being soldiers, but they are sufficiently seasoned for the more serious training behind the lines—the real place for practical instruction in the business of the fighting man.

Fresh air and exercise are regarded as the most important factors in the hardening process. In all weathers one will see the "rookies" out in the open at setting-up exercises, running, jumping, drilling, riding, at artillery practice, trench-work. Cold and wet make no difference. Stripped to their undershirts, with bared heads, these sturdy chaps are put through a grilling setting-up, which for length and severity make our light exercises seem like child's play.

In the meantime the windows of their huts have been left open all day long, and at night their regulations provide that a window (the upper-sash opening inward) at either end of the hut, in which thirty men sleep, must be kept open all night, the senior non-com. being held responsible.

Suspects and contacts, patients with mumps, and even measles, are not kept housed during their period of quarantine, but are marched out daily in formation for exercise and drill and take their meals in a separate mess-room. Even contacts with cerebrospinal meningitis are allowed similar freedom, care being exercised that they avoid the neighborhood of other troops.

During their absence from the quarantined huts all the windows are opened and the greatest care is exercised at night to secure free ventilation.

With these simple precautions the epidemics of contagious diseases, so common early in the war, were practically eliminated and the pulmonary complications of measles are rare. During my term of service as senior medical officer at our large rest camps in England I have had ample opportunities to test the soundness of the English theory that fresh air is a universal panacea. My British confreres came to the conclusion that the American soldiers hated it, and indeed it seemed so, for they habitually shut every window at night and stuffed up the ventilators, until threatened with severe penalties for their failure to comply with the local regulations. Even then inspections were necessary night and morning to insure proper ventilation.

Overcrowding and bad air are doubtless responsible for the spread of epidemic diseases in camps and barracks at home, and we cannot afford to have them over here. The remedy is simple.

Doubtless the average middleclass Englishman lays the foundation of his hardy constitution in the public schools, where the boys continue their outdoor sports in all weathers throughout the year, hatless and in the scantiest costumes. He makes no concessions to the weather from youth to age.

Careful inquiries have been made with the object of learning how the newly levied troops endured the cold and wet of Flanders. All the medical officers questioned testified to the remarkable absence of rheumatism, pneumonia and other diseases usually attributed to such exposure. The natural inference is that the hardening process to which they are subjected during training (with doubtless their acclimatization to similar weather conditions at home) is directly related to their tolerance in the trenches.

Many of the organizations in our National Guard are "soft" physically, especially those from the southern states, and this climate and that of France are hard on them. But when they become accustomed to fresh air and a lower temperature in their huts than they have at home, they will harden rapidly, though of course it will mean a survival of the fittest. It is a mistake to coddle them, for in the trenches no concessions are made to the weather.

H. C. Coe.

THE NATIONAL BOARD OF MEDICAL EXAMINERS AND THE MILITARY SERVICE

Following a recent visit of its members to the Medical Officers' Training Camps at Fort Oglethorpe, Ga., and Fort Riley, Kansas, the National Board of Medical Examiners has decided to hold examinations at these camps, beginning April 9.

These examinations will be held simultaneously in both places, representatives of the National Board proceeding there for the purpose, under the approval and with the encouragement of Surgeon General Gorgas.

There are about 2,500 medical officers constantly under training at these camps, including very many of the high class type of young men which the Board particularly desires to reach. The average age of one student battalion of 700 medical officers, recently analyzed, was about 32 years. The professional qualifications of these younger men are especially good.

Examination by the National Board of Medical Examiners, and its certificate of proficiency, now carry with the right to engage in medical practice in fourteen states without the necessity for undergoing local examination by state boards. Fourteen more are expected to offer similar concessions as soon as their legislatures meet and opportunity is had to amend the laws accordingly. Others will doubtless follow.

Subject to physical examination and grading for aptitude, the examination by the National Board is accepted for admission into the Medical Department of the Army and Navy, and the Public Health Service.

Steps are being taken to secure reciprocity as to medical examinations with Canada; and if the present examinations warrant, it is contemplated holding them overseas with a view to impressing the medical authorities of Great Britain and France, and securing therefrom reciprocity entitling approved candidates to practice their profession in those countries.

In the readjustment of the profession which will inevitably occur during and after the present war, many medical officers will doubtless change their residential state or country and desire to establish themselves in practice elsewhere.

The present examinations offer an opportunity to do this at any time, or to enter one of the government medical services, should the successful applicant so desire. E. L. M.

COMMENT AND CRITICISM

ADVICE FROM THE FATHERS

Col. Frederick P. Reynolds, M. C., U. S. Army, now at the front, sends THE MILITARY SURGEON an extract from Dr. Benjamin Rush's "Directions for Preserving the Health of Soldiers. Recommended to the Consideration of the Officers of the Army of the United States," MDCC, LXXVIII, with the following comment:

In looking over my collection of pamphlets recently I ran across one which I have been keeping for some time. In reading it again it occurred to me how well the recommendations made therein apply to present conditions in our Army. With this thought in mind I have made a copy of the concluding paragraphs of the pamphlet thinking perhaps you might care to publish them in the journal.

We take great pleasure in publishing this, not only because of the soundness of the advice, but also to evidence that military sanitation was not born April 6, 1917, the day we declared war against Germany. There can be no question that military medicine dates from the dawn of history. "Aesculapius, who sailed with Jason in search of the Golden Fleece, and Machaon, who, summoned by Agamemnon, dressed the wounds of Menelaus, 'far on the ringing plain of windy Troy,'" were prototypes of the military medical officer of to-day. The traditions and customs of this branch of our profession have grown through the ages and demand the greatest respect and consideration.—THE EDITOR.

Dr. Rush writes:

I shall conclude these directions by suggesting a few hints which appear to be worthy of the attention of the gentlemen of the Army.

Consider, in the first place, that the principal study of an officer, in the time of war, should be to save the blood of his men. An heroic exploit is admired most when it has been performed with the loss of a few lives. But if it be meritorious to save the lives of soldiers by skill and attention in the field, why should it be thought less so to preserve them by skill and attention of another kind, in a march or an encampment? And, on the contrary, if it be criminal in an officer to sacrifice the lives of thousands by his temerity in a battle, why should it be thought less so to sacrifice twice their number in a hospital by his negligence?

Consider, in the second place, that an attention to the health of your soldiers is absolutely necessary to form a great military character. Had it not been for this eminent quality, Xenophon would never

have led ten thousand Greeks for fifteen months through a cold and most inhospitable country; nor would Fabius have kept that army together, without it, which conquered Hannibal and delivered Rome.

Consider, thirdly, that the discipline necessary to make an army victorious requires that the principle of self-preservation should in some measure be suspended in a soldier. If he be taught that it is a crime to have a single thought about his life in the field, he will soon transfer the same indifference about his life to the camp, or to his quarters. It argues, therefore, a want of understanding in an officer to charge his men with carelessness of their health and lives. Julius Caesar wanted nothing but strength in a man to make him a soldier. He supplied every other want from his own great fund of military qualities. Nature has given the Americans strength, and the sacred cause of liberty has given them principle above the common soldiers of any other army upon the face of the earth. The blame, therefore, will only be yours, if they are not made superior to them in all the arts which improve and adorn a soldier's person and character.

Lastly, consider that your country and posterity look up to you for the preservation of the only means of establishing the liberties of America. The wisdom and eloquence of writers and orators have long since yielded to the more powerful oratory of the sword. All our hopes, therefore, are in our Army. But if anything can be added to these motives, consider further that there is scarcely a soldier under your command who has not a mother, a wife, a sister, or a child. These helpless members of society made great sacrifices to their country when they urged the beloved objects of their affection to follow the recruiting drum to the camp. Whenever therefore, your duty requires that you should attend to the health of your men, imagine you see one or perhaps *all* of their female and helpless connections standing at the door of your tents or quarters, and beseeching you by the remembrance of the pleasures you have enjoyed, and by the prospect of the pleasures you expect, in those connections, to repair immediately to the tents or huts of your men, and to attend to everything which reason and conscience tell you are necessary for the preservation of their health and lives.

ARM AND KNEE LOCK[1]

Capt. Howard C. Naffziger, M. R. C., has devised a method of carrying an unconscious patient by one bearer which seems very practical. Captain Naffziger writes that he presents his method in the hope that it may prove worthy of wide use. He says:

The difficulty in picking up a completely relaxed or unconscious person from the ground under the best conditions is great. The usual methods often require that the patient be carried in an uncomfortable

[1]With six illustrations.

position or else by a hold that is difficult to maintain. By the method illustrated the carrier is able to pick up a man of his own weight without strain and carry him in a comfortable position where he can be observed. One hand of the bearer is free to support the patient's head, open doors, or support an injured part. The accompanying illustrations of the method were made from a bearer weighing 135 pounds and a patient weighing 165 pounds. To lift a patient from the ground the steps are as illustrated.

Step 1 (Fig. 1).—Kneel on the right knee at the patient's left. Lift the patient's knees and flex his thighs well on his abdomen, slipping the bearer's left knee under patient's legs. The bearer then passes the left arm well beneath the patient's knees. The legs are well elevated and rest on the bearer's left shoulder so that the elbow and lower arm are free. The patient's left arm is lifted and his hand grasped firmly by the left hand of the bearer. By holding the patient's left arm, as shown in Fig. 1, a large space remains between the patient's arm, his thighs and his body. The bearer's right knee during this procedure is resting on the ground close to the patient's left side.

Step 2 (Fig. 2).—The bearer, bending forward, passes his head under the patient's left arm without otherwise altering his hold. The bend of the patient's elbow should rest well down on the base of the bearer's neck and not high up towards the head. The right hand of the bearer rests on the ground after this adjustment is made.

Step 3 (Fig. 3).—Keeping his right hand on the ground to assist himself, the bearer straightens up. By this maneuver the patient is pulled upward on the bearer's right thigh as on a skid. He should be drawn upward until he rests against the body of the bearer and high up on his right thigh.

Step 4 (Fig. 4).—The bearer now assists with his right hand to transfer the patient to his left knee. The patient is shifted to a sitting position on the point of the left knee. It is important that the position be correct. He should be balanced in a sitting position well out on the point of the knee. If close to the body of the bearer it is difficult to arise. During all of the six steps the grip and position of the left hand is never altered.

Step 5 (Fig. 5).—With the patient in the proper position nearly all of his weight is on the left knee of the bearer, where it remains until the bearer has arisen sufficiently for him to slide off. The bearer arises, assisting himself with his right hand, which is now free, on his right knee.

Fig. 6 shows the final position for carrying. The patient cannot slip. The position is secure and does not require a tight grip. The right hand of the bearer is free to support the patient's had or the other arm. The color and condition of the patient can be observed. The chest and abdomen are not compressed. For left-handed persons or with injury to the patient's left arm or left side of the body, the same

Fig. 1.

Fig. 2.

(To face page 461.)

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

hold can be reversed, the bearer being on the patient's right and using the right arm. The lifting of the patient from a table is extremely easy, steps 3 and 4 being omitted. In carrying patients who are of short, stocky build it will sometimes be found that there is not sufficient space for the head and neck of the bearer. In such a case the arm of the bearer should pass beneath only one knee of the patient, the leg nearest him being allowed to hang. This gives adequate room. A patient can thus be easily, comfortably and securely handled and with less effort than by other methods we have tried.

FOOD CONSERVATION IN MILITARY HOSPITALS

An economical use of food has always been fundamental to really good housekeeping, and the appeal now making to "save food and win the war" has no application to such, for "saving food," in the proper sense of the term, is the essence of good housekeeping. But a good housekeeper is a *rara avis,* and such birds are usually of the feminine gender, while among men housekeeping, like olives, is an acquired taste and rarely reaches above mediocrity.

We read of a considerable waste of food in our camps, and doubtless our hospitals are not wholly guiltless, so THE MILITARY SURGEON is glad to present the following views of Maj. John S. Dye, M. R. C., on duty at Base Hospital, Camp Sevier.—EDITOR.

To send two hundred and twenty million bushels of wheat to our allies, when we have a surplus of only eighty-nine millions, seems impossible until we realize that to have the required surplus we should get it down to a concrete basis and know the part that each individual must play; then it looks easy, for if each person saves weekly 1 pound of flour, 7 ounces of meat, 7 ounces of sugar, and 2 ounces of fat, it is done. After our personal experience in food conservation at this hospital the statement that "Enough food is wasted in America to feed France" appears to us a fair, but awful indictment.

Early in the organization of this hospital it was realized that a great deal of good could be accomplished by proper conservation of food and prevention of waste. There have been apparently insurmountable obstacles presented in this work, such as inexperienced cooks, unaccustomed to handling army rations, inexperienced help in all departments; and with the exception of the commanding officer and one other officer, there was not a single man connected with the base hospital here with any considerable army training. On or about October 25, 1917, Major Scott, commanding the base hospital, detailed verbally Maj. E. H. Goodman, Capt. C. W. Woodall and myself to look into the matter, and a few days later issued the following memorandum, at our suggestion.

MEMORANDUM

1. After each meal, all foods that are left from the various messes of this hospital will be separated into different kinds, such as meats, breads, vegetables, etc., and will be inspected by an officer before it is incinerated.

2. Lieutenant Woodall will make this inspection at the general mess, and Major Dye at the officers' mess, nurses' mess and the hospital corps' mess.

3. Bread will be sent into the wards in loaves and cut there, and the slices, after being cut, will be cut in half and served. Foods sent back from the wards will be inspected before incinerating.

4. Note will be taken of the amount of waste from each ward and a report of the same made to the mess officer. Medical officers and nurses in charge of wards will use every effort to prevent the waste of all foods, particularly bread, butter, meats and sugar.

5. Food sent to the contagious wards will be sent in containers, great discretion will be used in the amount served to all patients, and the food remaining in the containers will be sent back to the mess and utilized. The bread sent into the contagious wards will be left there and used in making milk toasts, etc.

6. Food remaining in all other wards will be sent back to the mess and utilized.

7. The mess officer of the officers' mess, the mess officer of the hospital, of the detachment, and the nurse in charge of the nurses' mess will send a menu, of food served, to Major Dye's office daily.

8. The following Food Conservation Board has been appointed at this hospital: Maj. John S. Dye, Maj. Edward H. Goodman and Lieut. Charles W. Woodall. This board will act as a permanent advisory board in all matters pertaining to the supply, conservation, preparation and serving of foods in the hospital, and their recommendation and orders regarding the same will be obeyed and respected.

(Signed) T. E. Scott,
Major, M. C., Commanding.

This board was to exercise a wide range of power in all matters connected with the messing facilities of the hospital. It was made plain that the object of this board was not to reduce the food of the patients to a minimum; that all patients must have a sufficient amount of food, well prepared and served in an appetizing manner, so that there could be no excuse for waste on the part of consumers; that every man was to have all the food he desired; *that no one was to waste anything.*

The board then proceeded to make a complete and careful survey of the situation. It found that a great deal of food was not well prepared and not appetizing, due to the inexperience of the cooks, that the cooks themselves were making no effort to save food, and the patients

were also wasteful in the use of the food. Captain Woodall, the mess officer, found on investigation that the Medical Department men were getting from 5,500 to 6,000 calories per day; this was considered too much. The caloric value of foods fed to patients was also worked out for each meal, for a period of seven days, showing that the regular diet patients received on an average of 2,500 to 3,000 calories, light diets 2,200, and liquid diets 1,000 calories per day. This was considered a sufficient amount for men not performing manual labor. Experiment has shown that an individual in bed eight hours, and resting in a chair sixteen hours, uses 2,168 calories, while men on light duty, resting most of the time, will use 2,488 calories. A balanced menu, based on the above figures, is worked out each day, and this is multiplied by the number of men to be fed. We have found that the number of calories arrived at by this process is more than sufficient to satisfy the hunger and meet all physiological needs of the men. Men resting in the hospital do not require a diet of 3,500 calories, and such an amount is directly injurious in many cases in that it throws extra work on the metabolism of an individual whose physiological functions are below normal.

The first problem of the board was to secure earnest cooperation from the cooks and men handling the foods. With this object in view lectures were given to the Medical Department men, showing the necessity of saving and the methods by which it could be done. Cooks were given special talks and instruction in saving food, during its preparation. This propaganda of instruction was extended to the nurses so as to get their coöperation in the ward diet-kitchens. In each one of these talks, it was urged that every one write to the families and try to start a food conservation propaganda in the homes. For the purpose of interesting patients in the hospital and securing their entire coöperation, various signs were printed and hung in each ward. These are circulated daily so that a new sign is in each ward every day. Their value is considerable as a part of the conservation propaganda, but bears about the same relation to our work as talk bears to work the world over. The following are some of the signs:

1. Food wasted in America would feed France.
2. Don't take more food than you can eat, and don't eat more than you want.
3. If you waste food or eat more than is necessary here, you will go hungry in France.
4. Don't dig your grave with your own teeth.
5. Saving food will help win the war.
6. Eat such things as are placed before you.
7. For he that eateth and drinketh unworthily, eateth and drinketh damnation to himself.
8. Eat to live and don't live to eat.
9. "Damit" don't eat so much.

10. Be temperate in eating.
11. Take thought and refuse a biscuit.
12. Eat less and work more.
13. Let our hearts grow big and our bellies thin.
14. Waste is sin.
15. A clean plate will lick the Kaiser.
16. Empty garbage pails mean victory.
17. Not how much, but how, we eat, makes life.
18. Bridle your appetite or addle be your pate.
19. Too much food does not make us either stronger or brighter, but does make us fatter and duller.
20. A lean horse for a long race.
21. Nobody loves a fat soldier.
22. Conservation and care in the things we eat,
Spells Allies' success and German defeat.
23. If you clean up your plate and on food retrench,
You'll be helping the British, Belgians and French.
24. If you save on your sugar starches and fats,
You'll be handing the Kaiser a kick in the slats.
25. Use your brains at the table and don't eat too much;
This will go a long ways towards licking the Dutch.
26. In the matter of food conservation, be wiser;
It will strengthen our Allies and play "Hel'mit De Kaiser."
27. Don't let your eyes be bigger than your stomach.
28. Eat less, save more; drive the wolf to the Kaiser's door.
29. A fat soldier is no good.
30. Your stomach is not a storehouse; eat enough and stop.
31. The brute eats to satisfy desire; man eats for intellectual efficiency.
32. Test will power—eat less.
33. Economy means victory; waste means defeat.
34. Save, that those at home may live.
35. Heroes are not gluttons.
36. If the women are practicing economy, so should soldiers.
37. Brain and muscle need food, but excess means disease.
38. One way to beat the German sub. is to save on American grub.
39. He who wastes a crust of bread prolongs the war.
40. Save food and help the fighters fight.
41. Eat plenty, wisely, and without waste.
42. Fat is fuel for fighters; save it.

This bulletin was issued by the board:

Conservation of Meat.—There shall be one meatless meal each day and two meatless days each week, for all the messes in this hospital, including the officers' mess; substituting for meat, sea-food and articles of vegetable diet rich in protein.

Conservation of Wheat.—There shall be one wheatless day, or three

wheatless meals served during each week; corn, rice and other cereals being substituted for wheat.

Conservation of Sugar.—All sugar and desserts requiring sugar will be eliminated from the noon-day meal, except on Sunday.

Conservation of Fats.—No butter will be served at the noon meal except on Sunday, and the frying of food in fats will be avoided as much as possible.

Conservation of Waste.—At the end of each meal one of the board will inspect the waste from each mess, and the food returned from each ward, before it is incinerated or thrown into the garbage-cans. No meats, breads, cereals or potatoes, even if they have been on a man's plate, will be wasted, but it will be recooked and served again. except the food returned from the contagious and venereal wards. Bread will be sent to the wards in loaves, and the ward surgeon or nurse in charge will see that the slices are cut thin and then cut in half. The patient may have as many half slices as he requires. In the contagious and venereal wards, the bread will not be returned to the mess, but kept in the ward for making toasts.

When waste is discovered in foods returned from a ward, it is reported to the mess officer, who in turn calls on the ward surgeon for an explanation. Nurses and ward surgeons are held responsible that no waste occurs. Food is taken into the wards in quantities, and individual service made from the ward diet-kitchen. Any excessive waste from a ward is not only ample proof that negligence has occurred, but is also proof that a sufficiency of food is served to the ward; so that a nurse stating that her patients have not had enough to eat must first show that she has not thrown in the garbage-can food intended for such patients. The object of the board in controlling this waste has been to place the responsibility for the waste directly on the person who is responsible, and in this way immediate and definite results are obtained. Ward surgeons and nurses are instructed by the mess officer that they may have for their patients all the food desired; that if one serving is not sufficient, as many more as are necessary may be made, so that there has been no restriction whatever in the amount of food furnished the wards. It is only that they must show that such food has been properly used and none wasted. This statement is in apparent contradiction to the statement that a certain number of calories of food are furnished to certain classes of patients, but rations prepared by our caloric estimates have proved more than ample, so that the surplus enters into the estimate of the amount to be cooked for the next meal. Special diet cases, and seriously sick cases, of course are fed all articles required for by the ward-surgeon, no restrictions whatever being placed on these.

All kinds of foods, such as meats, bread and vegetables, are returned from the wards in separate dishes. In the kitchens the cooks keep their various kinds of waste in separate containers. Dirt is matter out of place; garbage is food out of place.

Because of the work of our board, the reduction in waste has been most remarkable. From an inordinate waste of large amounts of perfectly good food, and particularly of those foods that we must save—wheat, meats, fats and sugars—the hospital has reached a point where there is not more than one ordinary garbage can full of waste daily, most of this being vegetable material that cannot be re-served. Apple and orange peeling, celery tops, and other coarse materials are not included in this estimate. Knowing that there would be a certain amount of unavoidable waste, chickens were bought for the purpose of using that portion that could not possibly be saved, but at the present time food is conserved to such an extent that it has been necessary to supplement our waste with chicken feed.

Another step taken by the board is the question of saving grease, by means of specially constructed grease-traps. Hoppers are to be built for the collection of ashes from the wood burned in the incinerators. The lye taken from these ashes, and the grease saved from the traps, will furnish a large amount of soap for hospital purposes The work is under way, but the actual data cannot be given. The utilizing of bones for making bone-black is a further saving suggested by Major Nankivell, Division Sanitary Officer of the 30th Division.

The number of persons fed in the hospital, including patients, corpsmen, officers and nurses, runs between twelve and fourteen hundred daily, so that it can readily be seen that the messing problem, even aside from the waste, is no small matter. To see that every man gets all he needs and wants, well cooked and well served, entails no small amount of work. It is remarkable how willingly everyone co-operated after the first little difficulty of convincing them that this matter was a business proposition and not a passing fancy. The greatest problem connected with the work has been in securing suitable substitutes for fats, meats, wheat and sugar. Unfortunately the markets in this vicinity have been largely inadequate, and the local products have been exceedingly hard to secure.

Considerable money-saving has resulted directly from the work done. To save money, however, has not been our object; it is to save food needed elsewhere, and with such money saved it is intended to buy fresh vegetables and fish from distant markets. Correspondence with dealers in Florida has been started with the intention of getting weekly shipments of fresh vegetables, fish and shell foods. Poultry is also used, secured from the local markets when possible. Practically no foods are bought at retail prices, and everything carried by the commissary is, of course, used. For those things secured from dealers, arrangements have been made whereby wholesale prices are obtained and the usual trade discount secured. All articles of food for the entire hospital are purchased at wholesale rates by one officer, who keeps it in one storehouse and issues it to the different messes as required.

YET OTHER USES FOR THE ARMY LITTER[1]

Major Horace R. Allen, M. R. C., Director of Applied Surgical Mechanics at the Medical Officers' Training Camp, Camp Greenleaf, Ga., whose ingenious use of the hand-litter, described and illustrated in THE MILITARY SURGEON for January, 1918, has attracted wide attention, relates further uses he finds for this appliance, as follows:

The idea of substituting army hand litters for beds, in mobile or base hospitals, carries with it unpleasant conjectures. It suggests that we are progressing backwards at a critical moment when utmost efficiency is so tremendously essential. It is also quite obvious that any sane person would prefer a bed unless some serious injury to his spine, pelvis or lower extremeties had confined him to a litter for a few weeks. His experience would then confirm the experience of others who are willing to ignore the comfort provided in bed treatment, since the litter treatment more than compensates any possible advantages or other commendable qualities of bed treatment.

The surgeon and nurse naturally prefer the litter because of its undoubted superiority, but their choice is not sufficient for a decision. The patient must also be considered. It has been an almost invariable rule in my experience in private practice that a patient, with a fractured femur when removed from his bed and placed properly upon a litter, will refuse to return to the bed. It is to be presupposed that the litter will not be down on the floor, but will be up considerably higher than the average hospital bed, making it unnecessary for the nurses to bend over or to stoop every time it is necessary to attend the patient.

We have considered thus far only the advantages in comfort, to the patient, surgeon and nurse. But beside these, litter treatment gives a standard dependable result to the patient, facilitates accurate inspection by the surgeon, and provides a means of systematically standardized care for the nurse that no other known treatment can.

Aside from the surgical advantages, there is one tremendous military advantage to be gained through this system of using the litter. It is self-evident that a hospital of any kind should so far as possible be protected from direct fire from the enemy. Hospitals far in the rear have the disadvantages incumbent upon distance, consequently the hospitals well forward are more desirable; but the character of the terrain in sheltered areas is frequently unfit for hospital locations; not because the ground is low behind a hill, but because the use of low ground is impossible on account of being wet and muddy. With this new system it does not matter how wet and muddy the ground may be because each litter is high and dry with 2 or 3 feet of clearance between the patient and the mud. Also it might be well to mention a human element that has a very important bearing upon the patient's welfare. If the patients were down on the ground, on ticking stuffed with straw,

[1]With three illustrations.

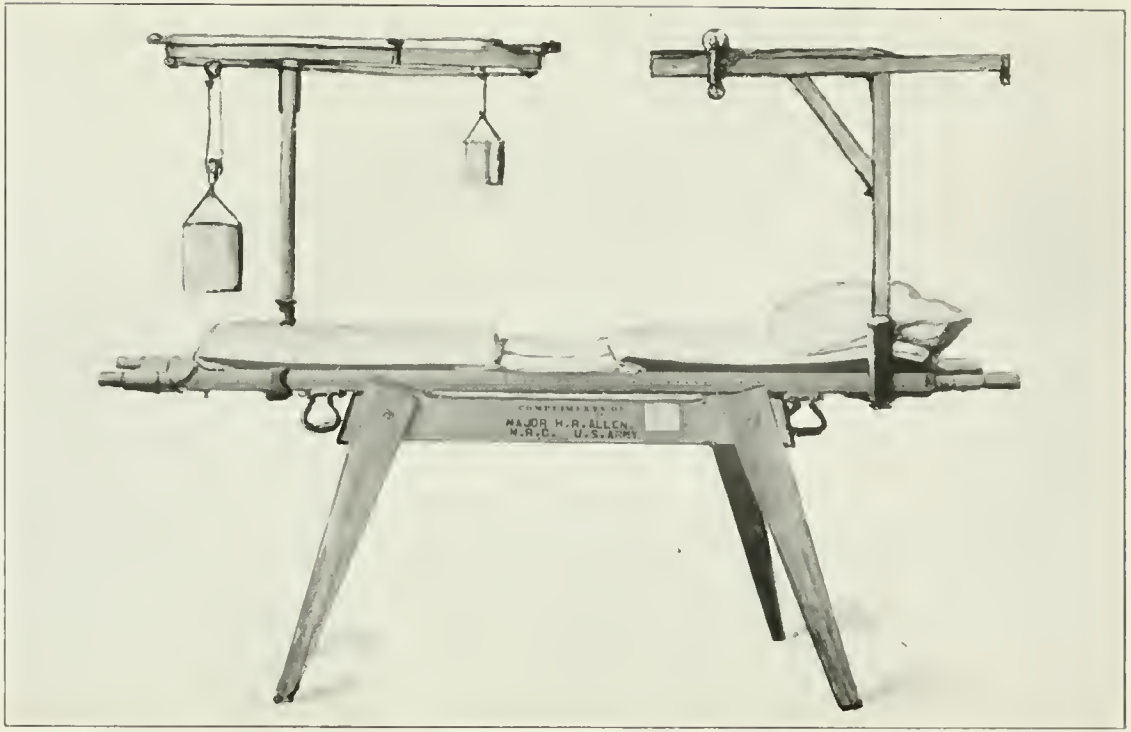
with muddy paths between them, they would not receive as much treatment nor as good attention as they would if they were up at a convenient working elevation.

There are two methods I have devised for keeping the army hand litter up off the ground, so that it may be used as a hospital bed, temporarily or permanently. The simplest method is that shown in the illustrations where four ordinary sticks pass up from the ground, to the desired height, and are attached to the litter through rectangular holes in the tread of the stirrups, and thence into sockets at the top, where they are held by loose fitting nails or pegs. Since these legs are further apart at the bottom than at the top, almost any kind of an old stick can be employed, because it will tighten up as soon as a load is put upon the litter. This device permits of quick detachment and removal of the loaded litter.

The second method depends upon the presence of a cheap litter table. This table is made of eight flat boards one inch thick, constructed on pyramidal lines, with the lower parts more separated than the upper, so that it also will tighten up when bearing the burden of a loaded litter. This is so constructed that it folds up into a space 6 inches wide, 8 inches deep, and 36 inches long. The table automatically locks itself in working position and at the same time possesses a few fool-proof qualities which prevent the litter from being placed upon it in any other than the correct position. It also prevents the litter from slipping either sideways or endways. If any part of it should break, it can easily be replaced by a flat board.

Since the Balkan frame has become so popular, as a means for temporary or permanent elevation of an injured part, it will be interesting to note how simple it is to provide this elevation, with or without motion and with or without counterbalances. The little swinging traveling crane may be on or off in a moment's time, fixed or mobile, and if mobile it possesses either balanced or unbalanced movements in every direction without restrictions and without being so bulky and cumbersome as the Balkan frame. Furthermore, the patient can be moved outdoors or into the operating room or into another ward without disturbing any conditions of treatment, all of which is impossible with the Balkan frame. To the vertical mast of the crane or an upward extension of it, irrigation containers may be secured. Extension appliances for the head and foot end of the litter, also a head rest for the litter, are clearly shown in illustrations. In the center of the canvas there should be a hole about 7 inches in diameter for bed-pan service. By removing the legs out of the rectangular sockets in the litter stirrups at the head of the litter and by using an ordinary backrest, a most comfortable reclining position at any angle may be secured.

In all the considerations for extending and improving the usefulness of the army litter one thought has been dominant, that was to make all devices consistent with the stretcher as it stands today and has stood for many years in the past, fixed and unalterable. The only



A Stretcher Table.

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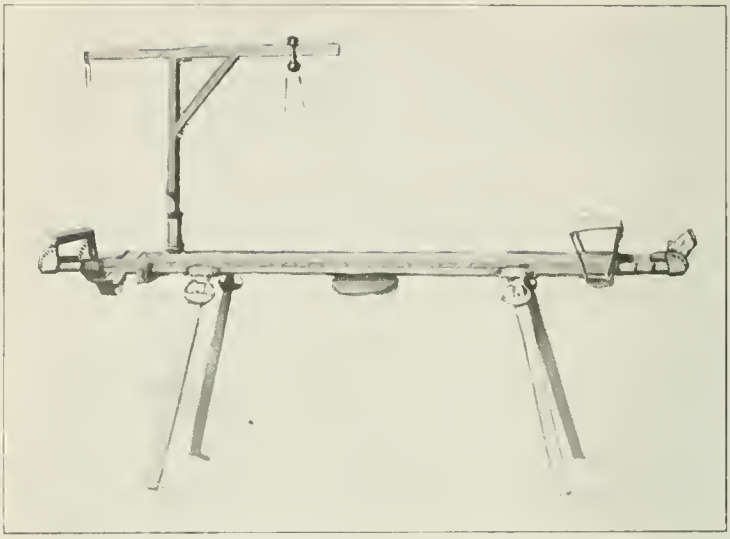
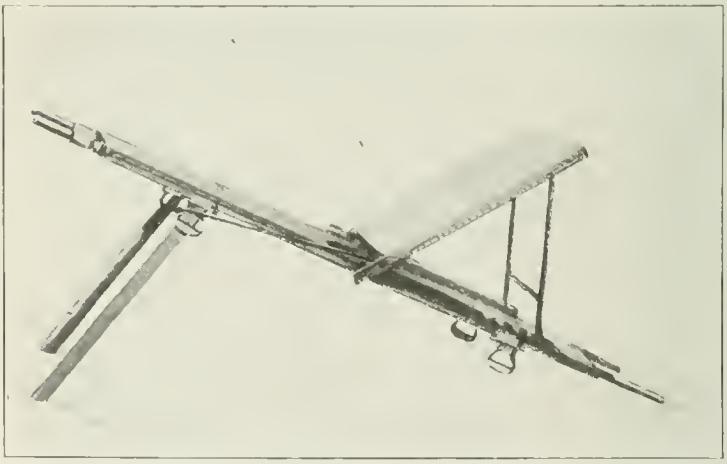


Hand-Litter Arranged as a Fracture Bed.



A Field Reclining Chair.

departures have been the hole in the canvas for bed-pan service and the rectangular holes and sockets in the stirrups. I have not changed either the weight or the dimensions. What I have added has been balanced by what I have taken away, but the advantages gained and the money saved in the suggested alterations would be so overwhelming that I cannot refrain from asking serious consideration of them.

Major Allen thus describes the accompanying illustrations:

Fig. 1.—A Field Fracture Bed.

A litter resting on four sticks passed through rectangular holes in the tread into the sockets at the top of the stirrups. At the head and foot of the litter are adjustable extensions. Near the head end is a head rest which is automatically locked in place when the spreader bars put the canvas on the stretch. In the middle is the bed-pan, attached to the canvas in such a way that it has to be open when attached and has to be closed in order to be detached. Near the foot end is a substitute for the Balkan frame, namely, a swinging traveling crane, balanced or unbalanced, capable of giving any variety of movements, or standing stationary. It can be attached or removed in less than one minute. The attachment piece crosses underneath the poles of the litter.

Fig. 2.—A Field Reclining Chair

By pulling the loose nails or pins out of the holes in the rear sticks, the head of the litter may be released and lowered. Any back rest may then ride upon the litter at any angle desired. The small rope anchoring the back-rest to the front stirrup prevents its receding from the bed-pan hole shown in the illustration.

Fig. 3.—A Stretcher Table

If there are no rectangular post holes in the stirrups the litter may be placed upon the pyramidal self-locking stretcher table. At the right end of the litter will be found the ordinary traveling swinging crane, balanced or unbalanced as desired, while at the other end will be found a swinging traveling crane which at all times automatically balances itself as well as the burden which it carries, regardless of the position or movements of the burden. The details of the construction of the various parts will be published later. It is quite obvious that the swinging traveling cranes can be attached to any part of the stretcher, supporting the patient in any desired position while he is being transported about the hospital. The stretcher table is more bulky and more expensive than the four sticks which make a hospital bed as shown in Fig. 1, yet one hospital bed with its spring and mattress and Balkan frame would cost more than twenty times as much as one of the tables, and it would be difficult to put a value on the four sticks, since packing boxes or any kind of lumber will suffice to make them from. The reclining position can be readily obtained with the litter table as illustrated in Fig. 2.

CURRENT LITERATURE

Measles and Pneumonia in Our Camps. Editorial in the *Journal of Laboratory and Clinical Medicine*, Vol. iii, No. 4, January, 1918, pp. 248–257, by Victor C. Vaughan, M.D., Editor-in-Chief.

The editorial covers almost the entire ground implied in the heading and is, without doubt, the combined result of a careful inspection and survey of the situation in camps, of detailed notes made on the spot, of a wide experience in preventive medicine, and of a thorough scientific appreciation of every detail connected with the whole question of camp sanitation. The reviewer feels impelled to express the wish that the editorial might be made to serve the functions of a "*bulletin from the Surgeon General's Office*," be distributed widely throughout our camps, and not alone among medical officers! Every one of us knows that in all questions of sanitation and preventive hygiene affecting an army in the field, the knowledge of the bottom facts on the part of its medical officers alone, or a recommendation on the part of a medical board of inspection, no matter how authoritative, is merely the beginning of a long and tedious journey and will remain at that point, unless followed up by a process of arousing the attention and living interest in the question of every officer and man in the camp. Every link in the continuous chain must be considered of equal importance. The personal interest of every officer and man in his own health must be aroused and that alone can be relied on to overcome the very apparent indifference so manifest in the large majority of them, and to be accounted for, almost exclusively, by an absolute ignorance of the whole question involved and the consequent lack of proper appreciation of the means to be employed to maintain it.

It is very apparent from a perusal of the editorial that the author conceives the importance of prevention to be greater than that of the cure, although not ready to recommend the direct exposure of susceptibles to measles in order to secure their immunity from them, on account of our inability to control complications and sequelae. In view of the fact that the disease is spread through droplet infection from the secretions of the upper respiratory tract and that we must assume that such secretions actually contain the living virus, would it be so impracticable a suggestion to make, to employ some of those secretions and vaccinate with them our susceptibles as we are in the habit of doing in vaccinating against smallpox? Since measles is often the recognized precursor of the dreaded pneumonia, the prevention of measles would mean the indirect prevention of pneumonia, a disease styled by our author as "rapidly winning the rank of captain of the hosts of death." Has the experiment ever been tried? Is it to be supposed, without any further experimental proof, that such a method of vaccination must necessarily produce the disease any more than our present mode of vaccination against smallpox produces smallpox.

With reference to the 'painstaking investigations of Cole,' of the Rockefeller Institute, having shown that pneumococci may be differentiated into several types and subtypes, "seeming to indicate that lobar pneumonia due to types I and II does not rise from infection with a pneumococcus which is habitually carried in the mouth, but that infection with those organisms occurs from without," the reviewer recalls the statement of Neufeld, made some fifteen years ago, to the effect that, by passing a pure culture through a series of rabbit, he had finally obtained a culture over 100,000 times more virulent than the one he started out with. Is it so impossible to assume that a coccus, passing through a cycle of development, from comparative benignity to such a degree of virulence, *might not show some morphological changes and some altered chemical reactions,* so as to make it appear as a new and different type; and would not a serum, produced from such a coccus of greatly increased virulence, naturally also contain a larger amount of antibodies than one produced from a coccus of less virulence and, therefore, prove more effectual in the prevention or treatment of the disease?

It may safely be considered beyond question that the dissemination of pneumonia is favored by overcrowding, through diminishing the infective range, through multiplying the chances of contact but, especially, through providing greater opportunity for the same germ to pass through a number of individuals in rapid succession and thus increase in virulence and, consequently, in fatality.

H. G. Beyer.

The Food of the Seaman in the Light of Present-day Hygiene and the Physiology of Nutrition, by Dr. C. M. Belli, col. med. nella R. Marina e libero docente l'Igiene. *Annali di Medicina Navale e Coloniale,* Anne xxiii, Vol. ii, Fasc. v-vi, Nov.-Dic., 1917, Pp. 867–885.

It appears that the author of the present paper, in a previous study of the Italian naval ration, had brought into prominence certain modifications made in it during the second half of 1916 and in January, 1917, owing to present war conditions. This reduced ration remained in force during the entire fiscal year of 1916-1917 and, on July 1, new tables were to be compiled. For this work, during the month of June, a commission was appointed, of which our author was elected a member, and charged with the special duty of ascertaining if and in how far the results of his previous studies might find application to the new ration tables.

For (*a*) *the ship's ration,* the general result seems to have been, in the main, a slight increase in the fuel value (oil) of the ration over that of the reduced ration until then in force.

The Italian people, according to Belli, are in a habit of using fatty substances much too sparingly, as a quasi-condiment only, and even in the old tables the quantity of oil allowed was positively insufficient for

proper and satisfactory preparation of the meals. An increase of 20 cc. of oil per day was therefore added, increasing the fuel value of the ration by 120 large calories.

Nevertheless, one of the tables, exhibiting the composition of the ship's ration, in force on July, 1914, shows the total fuel value of that ration as amounting to 3,319.2 large calories, while that in force July 1, 1917, has a calculated value of 2,933.1 calories, giving a minus value to the latter of 386.1 calories. These changes had been effected through the introduction of the following modifications: (1) an increase in fats (9.8 gms.); (2) an increase in kitchen salt (15 gms.); (3) a diminution in nitrogenous substances (18.6 gms.)—believed to have been excessive in former rations; (4) a diminution in carbohydrates (47 gms. in daily bread alone); and (5) a reduction in alcohol to half its former quantity. This ration, thus reduced by 386 large calories, is said by our author to correspond more nearly to a typical ration than the one in use before.

For (*b*) the *land ration*, the changes required were of a more complicated nature. The author admits that the naval shore ration for many years had been inferior in value to the one in use on board ship and that the successive reductions practiced on it, for war reasons, had still further impoverished it beyond measure. For a number of reasons adduced by the author and which it would lead us too far to recount, this ration required more radical changes than the sea ration. Thus, for example, the number of meals had to be increased from two to three; a certain monotonous uniformity had to be overcome; a small amount of tunny fish had to be added to the diet to render it more nearly equivalent to the sea ration, etc. But, notwithstanding the fact, mentioned by the author, that the daily bread portion, between 1914 and 1917, had on several occasions been gradually reduced from 700 to 550 gms. a day or by one-fifth of its ante-bellum quantity, he still accepts it as sufficient.

"From an examination of the above figures, we will find that the shore ration shows an increase in fats and salt, and a diminution in nitrogenous substances and carbohydrates, similarly to the ship's ration but, in general, although slightly enriched when compared with the tables of February 1, 1917, it is inferior to the ante-bellum ration (July 1, 1914) by 370 Ca."

In section iii of his paper, Belli estimates the actual value of the ship's ration, in food substances, as possessing a potential energy equal to 2,765.1 calories and that of the shore ration, without alcohol, to 2,584 calories. A preceding inquiry had shown that some groups of men living on a money ration were content with a ration amounting to 2,700 calories. On these and some other grounds he bases his defense for the sufficiency of the ration.

In section iv the author discusses somewhat in detail the variations and the additions to the average ration, made necessary under certain

circumstances such as unusually hard work, state of war, age, changes of climate, fresh vegetables and variety in meals, and for which certain regulations seem to have provided. He admits that criticisms are still possible and defects to be remedied; "but in a general way, through the reforms applied to the ration on the 1st of July, 1917, considerable progress has been made and another step forward been taken toward bringing up the food supply of the mariner to the requirements of hygiene and alimentary physiology."

The reviewer must confess that he is conscious of a feeling of profound sympathy with the author and the difficult problem which he was asked to solve. The responsibility, inherent in the task of bringing about a satisfactory compromise between a most desirable and necessary sufficiency in food supplies for his men, on the one hand, and the conforming to rather inconvenient economical limits, set by the government, on the other, was a heavy one. It would seem almost as if the principles of hygiene and of the physiology of nutrition had to be stretched to the breaking point in trying to make the result seem justifiable. Even as it is, no observations on the men, under the reduced rations, having been recorded, it is difficult to form an estimate as to how far either the physiological or the hygienic requirements of the men were met. The scales might have thrown some light on this question.

H. G. Beyer.

The Purification of Drinking Water on Board Ship—Ozonization or Boiling? by Dr. C. M. Belli, col. med. nella R. Marina. *Annali di Medicina Navale e Coloniale*, Anno xxiii, Vol. ii, Fasc. v-vi, Nov.-Dec., 1917, p. 839.

The good quality of water in naval hygiene plays as important a rôle as it does in municipal hygiene from the point of view of the protection of the health of the men. The distillation of sea water, as one of the sources of supply, is considered by the author as a *reserve* method; the more *common and customary* method is that of bringing water on board from land.

In the tanks located on the lower decks and exposed to great heat, where the water assumes a temperature of 30° C., the contained microbes largely increase in numbers, the water becoming unfit for drinking purposes, even assuming that these are non-pathogenic. Up to the beginning of the present century the only method in practice for obtaining a chemically and bacteriologically pure water was the distillation of sea water. Gradually other methods were introduced, and today the methods in actual use are: (*a*) distillation; (*b*) filtration; (*c*) chemical purification; (*d*) ultra-violet rays; (*e*) ozonization; (*f*) boiling. On account of the absence of clear and absolute criteria for the proper selection of means to be employed for the purification of water, there prevails a certain confusion. The writer concludes that ozonization does not sterilize and that boiling should be preferred.

H. G. Beyer.

BOOK REVIEWS

TUMORS OF THE NERVUS ACUSTICUS AND THE SYNDROME OF THE CEREBELLOPONTILE ANGLE, by Harvey Cushing, M.D., Professor of Surgery, at Harvard University. Philadelphia and London: W. B. Saunders Company, 1917. Cloth, $5.00 net.

Commencing with a historical review of this interesting but hitherto relatively unknown subject, the author goes over a number of case reports with clinical and pathological records and later discusses the etiology and symptomatology, and states that in 25 of the 30 cases, the inaugural symptoms were auditory; in some cases, buzzing in the ears, tinnitus; later, loss of hearing on the affected side; occasionally tinnitus has persisted after a complete loss of air conduction. He concludes that absolute deafness is almost as difficult to certify, as absolute loss of vestibular reaction in these cases; some patients showed preservation of hearing for certain tones, and in a smaller number, labyrinth reactions were obtained by the caloric tests.

Cerebellar symptoms in the average case appeared a year or two later than the acoustic symptoms. The first symptom to be noted was usually unsteadiness of gait, which may vary from day to day. Nystagmus of the cerebellar type, may appear and be difficult to differentiate clinically. The patient is not aware of it, and while it is an early symptom, it is often not recorded. The cerebral nerve symptoms are not constant; the fifth, sixth and seventh, are most frequently involved, while disturbances of the ninth, tenth, eleventh and twelfth, have been described. The so-called vagal attacks, are in the author's opinion, to be regarded as medullary involvement with increased tension and resultant disturbance of the cerebellum, which he describes as cerebellar crises. Among the general symptoms are headaches, choked discs and vomiting. Certain psychic disturbances are also recorded.

The tumors are described as grayish-yellow in appearance, more or less irregular in contour, particularly the large ones, and varied in size, from a growth 2.5 to 3 cm. in its long axis to one 7 cm. Histologically, they are described as showing two main types of tissue, one of dense interlacing fibrous bands, the other of loose, reticular tissue; when they occur together, the two are in most cases fairly sharply delimited from one another. In summarizing, the author says the isolated tumors involving the nervus acusticus, arise from the endoneurium, which is peculiar to this nerve, and gives them their distinctive histological appearance; they seem to originate as a rule, in the distal portion of the nerve within the auditory canal and consequently may cause through pressure absorption, a dilatation of the porus acusticus internus. From this point, the tumors spread inward, throughout the nerve, until it becomes completely involved and the adjoining structures in the cerebello-pontile angle suffer from secondary compression effects.

Diagnosis: The difficulty in diagnosis lies in that there are so many disorders causing tinnitus, labyrinthine vertigo, and deafness. When these primary auditory symptoms have been followed by numbness of the corre-

sponding side of the face, periods of diplopia and lowering vision, occipito-frontal pain, and stiffness of the neck, unsteadiness of gait, and ataxia, and finally, difficulty in swallowing and articulation, there is not much doubt about the diagnosis. Coupled with a choked disc, cervical rigidity and deafness, with absent labyrinth reactions, loss of corneal reflex, disturbance of taste, nystagmus, and muscular incoördination, the typical case becomes clear. The diagnostic mistakes are divided by the author into three groups: first, those in which the tumor syndrome is misinterpreted, and the symptoms ascribed to a different lesion, second, correct diagnosis of tumor, but incorrectly localized, third, those with the tumor diagnosis and correct localization in the cerebello-pontile angle, but the relation of the growth to the acusticus unappreciated.

Radiographic changes: Divided into evidences of increased pressure, as shown by widening of sinusoidal grooves, pressure absorption of the posterior clinoids, a diastasis of sutures, and a deepening of the convolutional impressions. Local indications of the lesion may be in evidence. The Barany tests have not furnished much more than confirmatory evidence in the author's opinion, although the favorable report of Grey's is quoted at length.

Surgical treatment: There have been several methods of approach devised, the unilateral operation described by Woolsey, which modified in one way or another has been favored by most surgeons. Practically, this consists of a unilateral sub-occipital craniectomy, done in one or two stages; the results unfortunately have shown an alarmingly high mortality.

The translabyrinthine operation with direct approach, through the pyramidal bone was suggested by Panse; the objections are complete destruction of the middle ear and homolateral facial paralysis. There is also great difficulty in working in such a deep and restricted field, and it does not serve as a palliative measure in case removal is impossible. Combined sub-occipital and petrosal approach was undertaken by Elsberg in 1904, but no successes have been reported. The bilateral operation is the one favored by the author, made through the cross-bow incision, was first described in 1905 and originally advocated for the purpose of exploration and decompression for lesions not definitely localized. The advantages enumerated, are, freedom of field, allowing dislocation outward of the unaffected hemispheres, and ability to diminish tension early in the operation. The anesthetic is given in the face-down position, using the Connell apparatus, giving warmed ether vapor, the patient is placed face down, and every possible precaution in making the flaps, is taken to avoid loss of blood. The craniectomy is performed by making one or more primary perforations with the motor driven burr, over each hemisphere and enlarging the openings with rongeurs. The dura will be found tense, and an opening is made low down near the foramen. If there is marked pressure, he advises immediate tapping of the ventricle. Encysted fluid within the arachnoid is often encountered, and on opening the cyst and carefully sponging away the fluid, the tumor may be seen. The idea of extirpation has been abandoned and the usual custom is to incise the capsule, and by an intracapsular operation, remove as much of the contents as possible. Finally, the vertical incision is closed in layers, using fine, waxed black silk sutures on curved French needles.

The transverse incision is then sutured. No vessels are tied during the operation.

Operative Mortality: In the Baltimore series of 11 operated cases, the mortality was 35.4; in the Boston series of 18 cases, the mortality was 11.1 per cent.

Results: A great degree of symptomatic relief, particularly the saving of vision. The duration of relief has varied from a very short period to seven years and ten months, and the average or fair expectation, as given by the author, as three years.

G. B. Trible.

Army and Navy Uniforms and Insignia, by Colonel Dion Williams, United States Marine Corps. Frederick A. Stokes Company.

"How to know rank, corps and service in the military and naval forces of the United States and foreign countries" is very desirable at this time, when our Army and Navy are taking part in the European War and so many officers and soldiers of friendly powers are ably assisting in the instruction of our men in the training camps, and placing the results of their experience at the disposal of our Government.

Colonel Williams in his handsome volume has given us all the necessary information upon this subject; perhaps for the first time it is given in popular form and fully illustrated—with flags, pennants, ribbons and air-craft marks in colors. In addition to the uniforms of our Army and Navy, those of the Coast Guard, Coast and Geodetic Survey, Light House Service and Public Health Service are described, also the service uniforms of Great Britain, France, Italy, Japan, Russia, Belgium, Germany and Austria-Hungary.

The opening and closing chapters on "Origin and History of Uniforms" and "Honors and Distinctions" are interesting and informing, as well as valuable for reference. An excellent index completes the work, which will doubtless establish itself as an authority upon the subject of which it treats.

George Andrews.

The Surgical Clinics of Chicago. Vol. i, No. 5, October, 1917. Philadelphia and London: W. B. Saunders Company.

The last number of the Surgical Clinics of Chicago, 1917, maintains the high excellence of the preceding numbers. This number opens with a clinic on "Benign Tumors of the Breast, Chronic Inflammations, and Carcinoma," by Dr. Arthur Dean Bevan, and it is well worth the careful attention of all readers who are fortunate enough to be subscribers to these excellent periodicals. Dr. Albert J. Ochsner, with his usual ability of presenting his subjects in a practical, understandable way, has an excellent, well-illustrated clinic on "Varicose Veins of the Leg."

A number of interesting clinical reports showing exceptional technical ability are made by Dr. M. L. Harris, on "Hernia of the Breast," E. W. Andrews on "Hemangioma of the Brain," and D. B. Phemister on "Brain Cyst Following Skull Fracture." A very remarkable clinic is reported by Dr. N. M. Percy

on "A Partial Evisceration Through the Vagina During Attempted Abortion," which illustrates what well-planned, well-executed surgery can do in even so serious and complicated a condition. A number of other excellent clinics by Carl Beck, H. L. Kretschmeyer, T. J. Watkins and others are contained in this volume. Two clinics on appendicitis are given, which are well worth thoughtful consideration, one by D. N. Eisenrath on "The Complications of Appendicitis," and the other by Hugh McKenna, on "The Early Recognition of Appendicitis."

In reviewing "General Surgery" of the Practical Medical Series, Volume ii, 1916, edited by the late Dr. John B. Murphy, I took occasion to note his remarks in the introduction, in which he called attention to the increasing mortality in appendicitis in large hospitals of this country, because early diagnosis had not been made. He said: "The subject needs to be all re-written by forceful teachers, every five to seven years," and it is with this idea in mind, and the reviewer's personal experience, that he wishes most particularly to commend the papers of Eisenrath and McKenna.

The Surgical Clinics of Chicago, published to date, have been searched through for a comprehensive clinical article on "Acute Intestinal Obstruction" that meets the diagnostic and technical knowledge of the period. Such a clinic has not been presented. Murphy, in the introduction to which reference has been made, says that from the most reliable statistics there is a mortality of 40 per cent in acute intestinal obstruction, including both internal and external, and that this frightful mortality is due to the fact that a diagnosis is not made in time for a life-saving operation.

A number of other excellent clinics will be found in this volume, to which space does not permit further reference. Every up-to-date surgeon and general practitioner who pretends to do operative surgery should be a subscriber to the Surgical Clinics of Chicago.

JNO. E. SUMMERS.

MILITARY ORTHOPEDIC SURGERY—MEDICAL WAR MANUAL No. 4. Prepared by the Orthopedic Council. Philadelphia and New York: Lea and Febinger. Price, $1.50.

This is the fourth of a series of manuals issued under the supervision of the Surgeon General of the Army and the Council of National Defense.

It presents in a condensed form the fundamentals of orthopedic practice and represents the combined work of America's leading orthopedic surgeons. The subject-matter is contained in eleven chapters. The chapter on "The Soldier's Foot and the Military Shoe: Prophylaxis," is largely taken from the work of Col. E. L. Munson, U. S. Army.

The authors state that they have drawn freely on the orthopedic experience of our allis and acknowledge their particular indebtedness to Col. Sir Robert Jones, who has contributed so much to orthopedic surgery.

This excellent little book will be indispensable to the military orthopedist and undoubtedly will be of value to the general military surgeon.

M. E. HIGGINS.

NOTES AFIELD

NOTES OF INTEREST GATHERED DURING A TOUR OF SEVERAL BRITISH AND FRENCH HOSPITALS IN THE DISTRICT OF —

By a Military Observer

In many of the hospitals the Carrel-Dakin solution is the universally used method of treatment for all infected wounds and also as a prophylactic treatment for all wounds of which the slightest doubt is entertained. Punctured wounds are converted into incised wounds, all badly bruised tissue is excised and Carrel-Dakin solution is started at once. Plenty of rubber tubing must be used and the skin surfaces around the wounds well protected by vaselined gauze. It must be remembered that the Carrel-Dakin tubes are used to bring the solution in contact with every portion of the wound and are not used in any sense as drainage tubes. The solution is used at room temperature and not by the so-called drop method.

Bacterial counts are made daily or every other day until the number of microörganisms are reduced to one-half to a field. When this time arrives, normal saline, or artificial serum as the French call it, may be substituted for the Carrel-Dakin solution. In some cases the wound is sutured at this time with very satisfactory results. Some of the British hospitals use a paste made of iodoform, bismuth and vaseline "(B.I.P.)" as a dressing following the Carrel-Dakin treatment.

Some very beautiful examples of color photography and ordinary photography with the use of the yellow filter, were observed. Very few end-results were seen because of the necessity of evacuating the hospitals as soon as patients can be transported comfortably to England for convalescence.

The hospital trains as used by the British are models of completeness and sanitary excellence. They consist of passenger coaches of the finest type, more like the American car than anything else seen on this side of the water. The ordinary hospital train consists of one car with compartments for the commanding officer, his one or two assistants and the nursing sisters along with a mess and bathing facilities for each group; an operating and dressing room car, a car for baggage and supplies, a varying number of ordinary coaches for the ambulant patients and coaches provided with racks on which the stretchers containing the recumbent patients are placed. These racks are so constructed that three tiers of stretchers can be accommodated on either side of the aisle.

One of these hospital trains will accommodate as many as 500 or 600 patients. A patient is never removed from the stretcher from the time he is placed in the ambulance at the evacuating point until his reception on the hospital ship and in some cases until his arrival at the convalescent hospital in England. The skill, ease and rapidity with which patients are handled is remarkable, and the happy expressions on the faces of even the severely wounded and seriously ill are the best evidence of the satisfactory manner in which the transportation of the sick and wounded is being carried out.

The hospital ships are equipped in much the same manner as the hospital trains, large wards taking the places of the rack cars.

The Carrel-Dakin treatment is carried on in hospital trains and ships just as carefully as in stationary hospitals. Minor operations and dressings are done with great success in the operating rooms of both classes of invalid transport.

The majority of the cases in the hospitals in this district are medical rather than surgical, the proportion being about 60 to 40 per cent. The average stay of the patient in the hospital is about 8 to 10 days. The principal diseases found are trench fever, pyrexia (of unknown origin), pneumonia, pleurisy, gas infection, gastroenteric infections, kidney and heart diseases and other diseases as met in civil practice.

SURGICAL NOTES

One thing which has impressed the observer in his tour of the hospitals has been the fine team work between the various medical officers as observed everywhere and nowhere to better advantage than in British General Hospital No. — at ———, which is manned by American medical personnel. The American base hospital unit, as organized at present, has a well-balanced medical staff representing all of the specialties. This has been taken advantage of in the treatment of all patients so that each specialist is thus enabled to give his best efforts to those to whom his services are of the greatest value, and at the same time bear his share of the routine ward work which is cared for by all.

While our hospital units were organized primarily to care for 500 patients, unusually heavy convoys have increased the number of patients to over twice the original capacity. Experience has proven that the number of medical officers—namely, 26 to 28—is sufficient even for the increased number of patients cared for at times, but both the nursing and enlisted staffs are inadequate to the demands thrown upon them. Instead of 65 nurses, 100 would be the proper number to give adequate nursing service with justice both to patient and nurse,

while 50 additional enlisted men would be able to care for the extra 500 patients without difficulty.

The utilization of railroad stations, hotels and other large buildings has worked out in a very satisfactory manner. Most of the buildings seen by the observer have been wonderfully well adapted to hospital purposes. Extra ward space has been provided by the building of temporary huts accommodating from 20 to 40 patients each.

Separate hospital buildings are provided for sick and injured officers and also in a large center like ——— a special hospital is operated for sick nursing sisters.

Isolation hospitals and convalescent camps also serve their useful needs, and a new convalescent hospital capable, I understand, of accommodating up to 40,000 patients, is now being built by the British at ———.

A surgical ward containing from 40 to 80 beds is in charge of a senior and a junior medical officer and a supervising nurse with three assistants. The usual hours for nurses' duty are from 7.30 a. m. to 8 p. m. with a half-hour off for noon meal, breakfast being taken before going on duty and dinner when coming off duty in the evening. If work is light, an hour for recreation is allowed in the latter part of the afternoon. In British General Hospital No. — at ——— a number of nurses' aides, having from one to two years' experience, are utilized and give great satisfaction. They do everything for the patients except surgical dressings and administration of medicines and relieve the graduate nurses of a great deal of work thus allowing them to assist the surgeons in doing surgical dressings.

When a convoy arrives from the front, patients are taken from the hospital train to the hospital usually in motor ambulances, are sorted out according to their field diagnosis cards, allowed to rest for a couple of hours and then each case is bathed carefully, dressed and a more definite diagnosis made. Unless operation or X-ray is very urgent these are put off until the following day. All patients receive a preliminary dose of 500 units of antitetanic serum at the casualty clearing station and a second dose in the hospital in from six to ten days from the time of the first injection.

A wound, whether sutured or not, which presents local tenderness and infiltration, even though it is not edematous and visibly infected, is incised at once and the incision carried through fascia or aponeurosis so as to allow the muscle to bulge freely. Carrel-Dakin treatment is started at once as a prophylactic measure. Many wounds of large size are not Carreled but are exposed to sunlight with great success. A large shell wound of the thigh or buttock, for instance, will be given

all the sunlight the patient can stand by moving his cot to the most exposed location, shading his face and covering the part with mosquito bar. This treatment is also very efficacious for extensive burns.

In the dressing of painful wounds a very valuable method of anesthetizing the patient is used without danger even though required daily. The formula of the anesthetic is as follows: Ethyl chloride, 5 cc.; chloroform, 1 cc.; ether, 24 cc. A piece of flannel cloth is saturated with the entire amount and placed over the patient's face, this covered with another piece of flannel, and this in turn covered with oiled silk containing a small aperture, fitting over the nostrils. This is tied around the patient's face with a bit of tape or rubber tubing. The anesthesia produced will last for ten minutes and the dressing can be started on the second breath. This anesthesia is apparently devoid of danger, is not accompanied by unpleasant complications, is followed by no deleterious after-effects, and is welcomed by the patient.

The officer of the day attends to all emergencies, but it has been found of great value to have him call the physician or surgeon in charge of the ward if a severe hemorrhage or unusual emergency arises at night. The officer of the day occupies a special bedroom at night which is known to everyone, so that no time is lost in reaching him if needed.

In all of the hospitals visited, both French and English, the supply of anesthetics, instruments and paraphernalia generally seemed to be ample.

The food in all hospitals was of good variety, quantity ample, and its preparation very satisfactory.

In hospitals not housed in permanent buildings, both wooden huts and canvas tents of various types are utilized. It has been observed that canvas tents, with double walls allowing an air space of 4 to 6 inches between, are much warmer than wooden huts.

It was noted with interest that, in the disposal of garbage and kitchen refuse, every effort is made to save all of the fats and drippings. As these are separated from the rest of the garbage they are run into tanks containing water, which is slowly and constantly changing. The fat rises to the surface of the water and at intervals is skimmed off, gathered up, and saved for glycerine-making. The rest of the garbage is incinerated.

In some places large settling pits are dug and are filled with old tin cans which have been previously flamed. Wash water and other liquid refuse from laundries and kitchens are allowed to drain into the ground through these pits.

Nothing has been observed in any of the hospitals, barracks or camps visited which in any way can compare with the latrines as

devised and used by the American Army. There has apparently been no attempt made in either British or French latrine construction to render the same fly-tight. Incineration of the feces is the method of disposal and, while it in itself is undoubtedly very satisfactory, it involves an unnecessary amount of labor in the cleaning out of latrine cans and conveying of this material to the incinerators. A disagreeable and unhealthy stench is produced during the whole process which is entirely obviated by the method of the American Army. The same criticism applies to urinals. The urinals observed usually consisted of ordinary galvanized iron or tin troughs which receive no other attention than an occasional flushing. The use of lamp black, asphaltum or coal oil is apparently unknown in these medical services.

The de-lousing stations, which are important adjuncts of every hospital, consist of portable steam-sterilizing outfits into which the clothing of new patients is placed. All clothes are subjected to steam sterilization at 215° F. for one hour to an hour and a quarter and then allowed to dry out in the sterilizer for 40 minutes thereafter.

Some hospitals have been achieving very satisfactory results in the treatment of infected wounds, particularly of joints and sinuses, by the injection of Eusol, which is a solution of chlorinated soda somewhat similar to the Carrel-Dakin solution but of greater germicidal power. This is injected directly into the diseased area every two hours or through tubes, the same as the Carrel-Dakin solution.

In some institutions ether was the anesthetic of choice, while in others, nitrous oxide and oxygen was the anesthetic most frequently used. This was true particularly in British General Hospital No. —, where a very ingenious portable anesthetic outfit devised in Cleveland, Ohio, rendered the administration of the gas very satisfactory.

In all of the hospitals visited it has been noted that the X-ray outfits are of antiquated design and sufficient electric current is not available to achieve satisfactory results, particularly in cases where time is important. Radiographic diagnosis of cranial injuries or of conditions in the abdominal cavity are made with more difficulty than should be necessary. It is hoped that in the American hospitals the extreme importance of the very best apparatus and sufficient current be recognized in order that much better work may be accomplished.

One thing noted by the observer has been the amount of unnecessary surgery and after-treatment, as well as undue prolongation of hospital confinement and subsequent unnecessary absence from the line, a large part of which could be avoided. This is due to too much unnecessary suturing of wounds in the casualty clearing stations.

While it is recognized that hemorrhage must be checked, sometimes

by ligature and again by suture, immediate closure of wounds in these stations is to be severely condemned. Many infected wounds, seen by the observer, have required immediate reopening, removal of sutures and Carrel or similar treatment, because of the stitching done in the casualty clearing stations.

A great deal of unnecessary time and labor is spent in work which only has to be undone and which really is to the detriment of the patient. In many cases wounds should be enlarged and packed instead of closed, in order to afford opportunity for cleansing and drainage. The minimum amount of suturing consistent with safety from hemorrhage should be employed. Any further treatment of the wound should be left to the hospitals farther back from the line. As suturing takes time and material, this work is not only unnecessary but harmful and is a break in the chain of efficiency which should obtain in our system of medical relief.

Troops landing in France after being confined on board ship and in camp for several weeks, are very apt, when allowed leave, to succumb to the temptations which beset them, particularly in a country like France. The experience of the British army has demonstrated the number of venereal diseases encountered among their troops is very large, and very elaborate hospital arrangements have been made for the treatment of officers and men suffering from these diseases.

British General Hospital No. — is a large institution of over 3,000 beds devoted entirely to the treatment of syphilis, gonorrhea and chancroid. Four hundred of these beds are for officers. This is one of four similar hospitals conducted by the Royal Army Medical Corps for the treatment of these diseases. It is situated in the suburbs of ——— amid beautiful surroundings. It consists of huts, bungalows and tentage, the streets are well paved and perfectly drained, rows of shrubs and flowering plants line these streets and everything conducive to the comfort of the inmates has been provided.

A well-equipped operating room, with special wards for surgical cases, is one of the many good features of the institution. The salvarsan room contains six tables with arm-rests, irrigator stands, etc., and the intravenous treatment is frequently given to six patients at the same time. The intramuscular injection of neosalvarsan is used in a great many more cases than the intravenous—of old salvarsan—and with most excellent results.

The number of cases of syphilis treated in this hospital since January 1, 1915, was 11,500. To these cases were administered over 89,000 injections of salvarsan and neosalvarsan. The number of cases of dermatitis and jaundice developing was only 152, and the number of deaths occurring in this whole series was either 10 or 11.

As a result of the treatment in this hospital the number of troops returned to the front effective for duty was over 11,000 while the number invalided to England in the last year was only 70, which is but a fraction of the number heretofore sent home.

The French and English preparations, similar to neo-salvarsan and old salvarsan, have proven fully as efficacious, and the standard treatment for syphilis in this hospital consists in the combination of the intramuscular injection of a suspension of metallic mercury, in sterile oil and water in conjunction with the intramuscular injection of neo-salvarsan as well as the intravenous use of old salvarsan.

The Wassermann test is used on all cases before returning them to the front, but patients symptomatically cured, even though exhibiting a positive Wassermann reaction, are nevertheless returned to the front because they are again effective for full military duty.

The proportion of cases of syphilis to gonorrhea is one to three. Gonorrhea here as elsewhere has proven more resistant to treatment than syphilis. The recent cases are treated with a 1 to 4,000 solution of potassium permanganate used in the ordinary way as urethral irrigations. The cases of long standing are being treated with gonococcus vaccine, which is made in the hospital laboratory, and also by means of urethral bougies impregnated with any one of the various salts commonly used for the purpose.

On inquiry as to why venereal prophylaxis was not carried out in the British army as it is in the American, I was informed that public sentiment in Great Britain had not as yet been educated up to the same point as in America, and the frank discussion of these matters was still more or less taboo. Moreover, one of the medical officers in charge made the statement that he feared that if a soldier contracting a venereal disease and not reporting for prophylactic treatment, as required in our army, would, by endeavoring to conceal his condition, so neglect himself as to become a much more difficult case to handle when concealment was finally no longer possible.

The other three hospitals devoted entirely to this purpose and conducted by the British Army are just as busy as No. —, so the enormous number of non-effectives caused by prevalence of venereal disease can be easily demonstrated.

Inasmuch as the startling prevalence of venereal diseases in France has been demonstrated by the experience of the armies stationed here, it is hoped that in spite of our excellent measures of prophylaxis that the A. E. F. will have sufficient hospitals in readiness for the treatment of such of our forces as become infected in spite of all of our preventive measures.

The most interesting thing observed during my several visits to British General Hospital No. — at ——— has been the research work being carried on in the hospital laboratory by Captain Pappenheim, M. R. C., U. S. A.

He has isolated a disc-like organism from a number of patients suffering from trench fever and has grown this organism on artificial media as well as on blood serum. It is found in the periosteum and around the blood vessels of the tibialis anticus muscle but not in the muscle fiber itself, and also is easily found in the stomach walls of the body louse.

The organism, as stated above, is disc-shaped, about one-thirtieth to one-fortieth the size of a red blood corpuscle and is best observed when overlying the corpuscle. It stains with the Wright-Gresima stain (heated), also with Hematoxyln after being fixed with Zenkers. It will also stain with hot Azure 2, Zeihl Neilson (without much discolorization) and hot ordinary weak carbolfuchsim. It will not stain with Eosin or Gram except as a counter stain. The organisms are evidently protoplasm.

This organism is cultured by dropping a small fragment of periosteum removed from the tibia into a slant agar culture tube. After four days' incubation a dark, cottony cloudiness will appear just below the junction of the agar and the water of condensation. The organism becomes encapsulated in eight days and appears in a sort of hanging drop formation in the tube. Under the high power, the disc when superimposed on a red blood corpuscle looks not unlike a small crescent-shaped nucleus occupying about one-fifth of the area of the disc, the balance being very faintly outlined, but nevertheless visible. As many as six will be found in a field. In the organisms which are evidently older, the so-called nucleus appears to be split into a number of sections of irregular shape. These older organisms are distinctly encapsulated.

As stated above, the organism has been found in every case of trench fever in the periosteum of the tibialis anticus where the pain of the disease is located. It has also been found in the blood of a few cases. Efforts are now being made to perfect the technique of blood culture in this work. The organism has also been found with great ease in the body louse as found on patients returning from the front and has best been demonstrated in saggital sections of the stomach wall of the louse.

INSTRUMENTS AND APPLIANCES

TEMPORARY ARTIFICIAL LIMBS

Office of the Surgeon General, U. S. Army
The Division of Military Orthopedic Surgery

The early application of some form of artificial limb has many advantages. In leg amputations, early functional use as a prerequisite for end bearing has been already discussed in The Military Surgeon.[1] To provide properly for this some form of temporary appliance must be supplied as soon as the stump has become sufficiently hardened by the routine treatment prescribed. The use of such an appliance also shortens the period of incapacity for work and thus enables the vocational training to be begun much earlier. The benefit to the patient's morale is obvious. In amputation of a single arm a temporary appliance is neither necessary nor indeed advisable; it seems preferable for the patient to first acquire the greatest possible facility with the remaining arm. In amputation of both arms, however, a simple appliance that can be used as soon as the stump is healed is of the greatest assistance.

The appliances to be described meet all the early indications satisfactorily. They are easily and quickly made, cheap and comfortable; the materials necessary can be readily obtained. They seem to possess sufficient advantages over other types of improvised appliances to recommend their adoption.

PLASTER PEG-LEG FOR THIGH AMPUTATION[2]

Materials.—Stock frame. For this the following are required: (1) two side bars of wood, preferably white pine, 36 inches long, 1¼ inches wide and ⅜ inch thick, rounded on the outside edges (Fig. 1D); (2) a foot piece of similar wood, 4 inches long, round and tapered so that the diameter at the bottom is 2 inches and at the top 2½ inches (Fig. 1E). This block is cut out so that 2 inches of the side bars may be set in flush on each side. The side bars are screwed to the foot piece (Fig 1C). A rubber heel is attached to the bottom of the foot piece. This completes the stock frame.

Felt, ¼ inch thick. Plaster of Paris bandages, 5 inches wide. Webbing, 1¼ to 1¾ inches wide; the front strap is 24 inches long: the rear strap is 48 inches long. Buckle, of proper width for webbing, attached to the upper end of the front strap. Carpet tacks. Gauze or muslin bandage.

[1] Amputations and Artificial Limbs: The Military Surgeon, 1918, xlii, No. 2, p. 164.
[2] Modified from Depage.

Construction.—1. *Shaping the felt for the socket.*—Measure and cut the felt to fit the stump, allowing 2 inches as a cuff to turn over the upper edge of the finished peg-leg. The measurements required are: (*a*) Circumference at lower end of stump. (*b*) Circumference at perineum, transverse. (*c*) Circumference at perineum, oblique, the tape passing over great trochanter (*d*) Length from

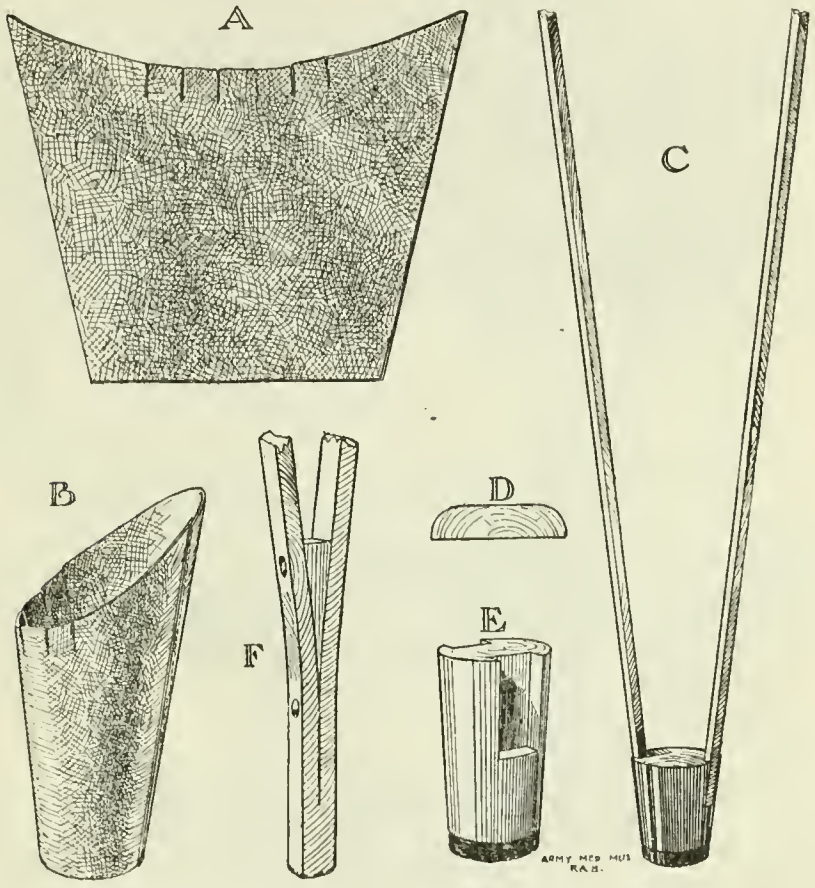


Fig. 1.—Materials Needed for Making Peg-leg.

perineum to end of stump. (*e*) Length from great trochanter to end of stump. The edges of the felt to be approximated by sewing should be the length of measurement (*e*) plus 2 inches and should lie on the outer side of the stump. Stretch the upper edge of the felt or score it, as in Fig. 1A. Bring the patient to the edge of the table.

2. *Applying the felt socket.*—Apply the felt to the stump (Fig. 2). Sew the outside edges of the felt and, when end-bearing is pos-

sible, the bottom also, trimming as may be needed. While sewing, the felt should be held well up against the tuberosity of the ischium by a bandage passed under the perineum, the two ends of the bandage

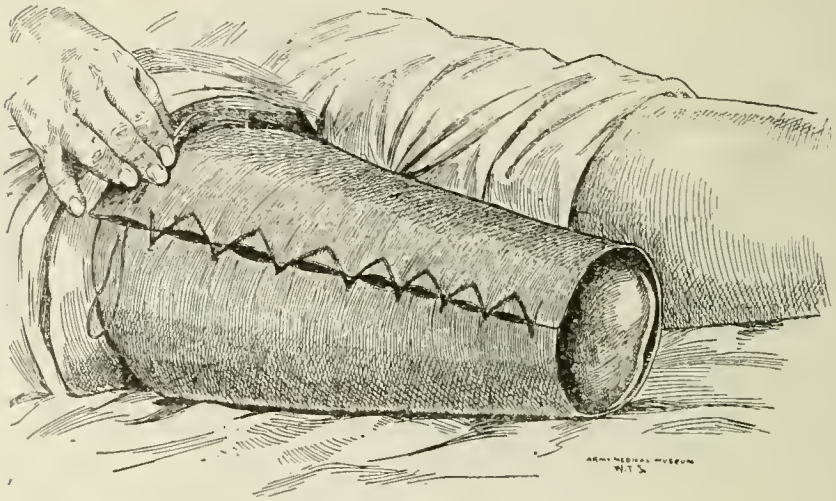


FIG. 2.—APPLICATION OF THE FELT SOCKET.

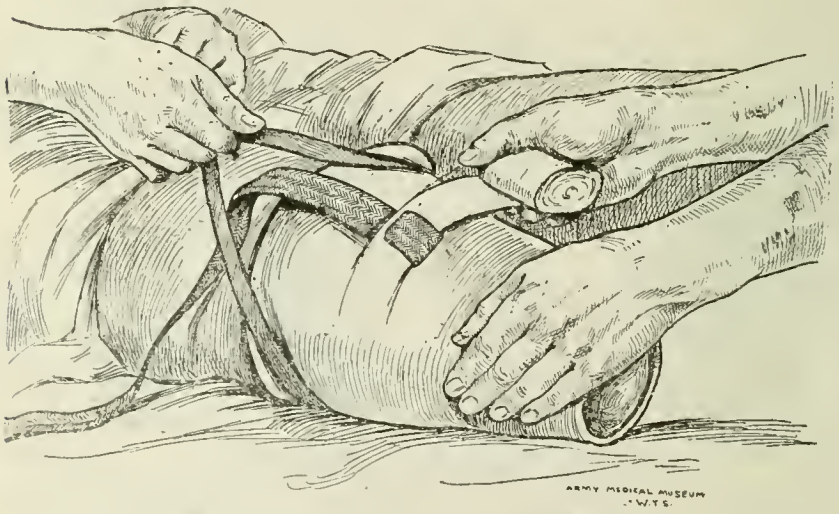


FIG. 3.—APPLICATION OF THE PLASTER SOCKET, SHOWING (1) THE METHOD OF HOLDING THE FELT AND PLASTER AGAINST THE PERINEUM AND (2) THE METHOD OF ATTACHING THE SHOULDER STRAPS.

being pulled taut by the patient. The upper 2 inches of the felt is folded over the bandage to form a cuff.

3. *Adapting the stock frame.*—A stock frame is cut to the proper

length so that when fitted to the socket the total length will be that of the other leg *with the shoe on.* The exernal side bar should be 2 or 3 inches longer than the internal side bar. Three or four carpet tacks are driven into the upper ends of side bars, allowing the heads of tacks to project from ⅛ inch to ¼ inch. This is then laid aside until needed.

4. *Applying the plaster socket.*—With the felt held up well against the ischium, apply one plaster bandage the whole length, being careful not to cover in the cuff (Fig. 3). While this is being done an assistant is making a plate of plaster bandage, of a size about half the circumferenee of upper end of the stump and 5 inches in width. This is then applied to the inner side of the stump and

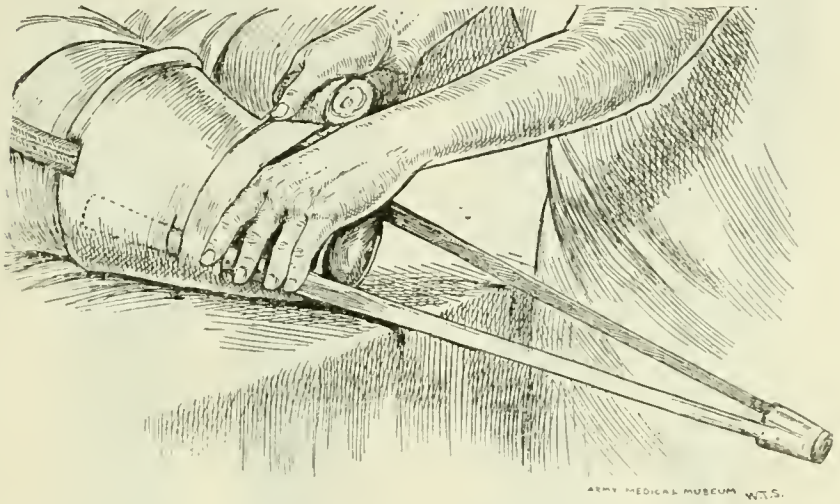


Fig. 4.—Attaching the Stock Frame.

held up against the isehium in the same manner as was the felt and by the same plain bandage, allowing 1 inch of the plaster plate to face over the bandage. This plate is thoroughly moulded to the parts.

5. *Attaching the shoulder straps.*—The short piece of webbing strap is next placed on the front of the stump and the long piece on the rear and fixed in place by four or five turns of plaster bandage (Fig. 3). After one or two turns of plaster bandage the free lower ends of the strap webbing are turned up and covered in with the subsequent turns. These shoulder straps should be buried in plaster to within 1 or 2 inches of the top of the socket of the peg-leg and should slant toward the opposite shoulder.

6. *Attaching the stock frame.*—Place the prepared stock frame on the felt and plaster socket, holding the side bars parallel with the line of the femur (Fig. 4). The length should be verified by com-

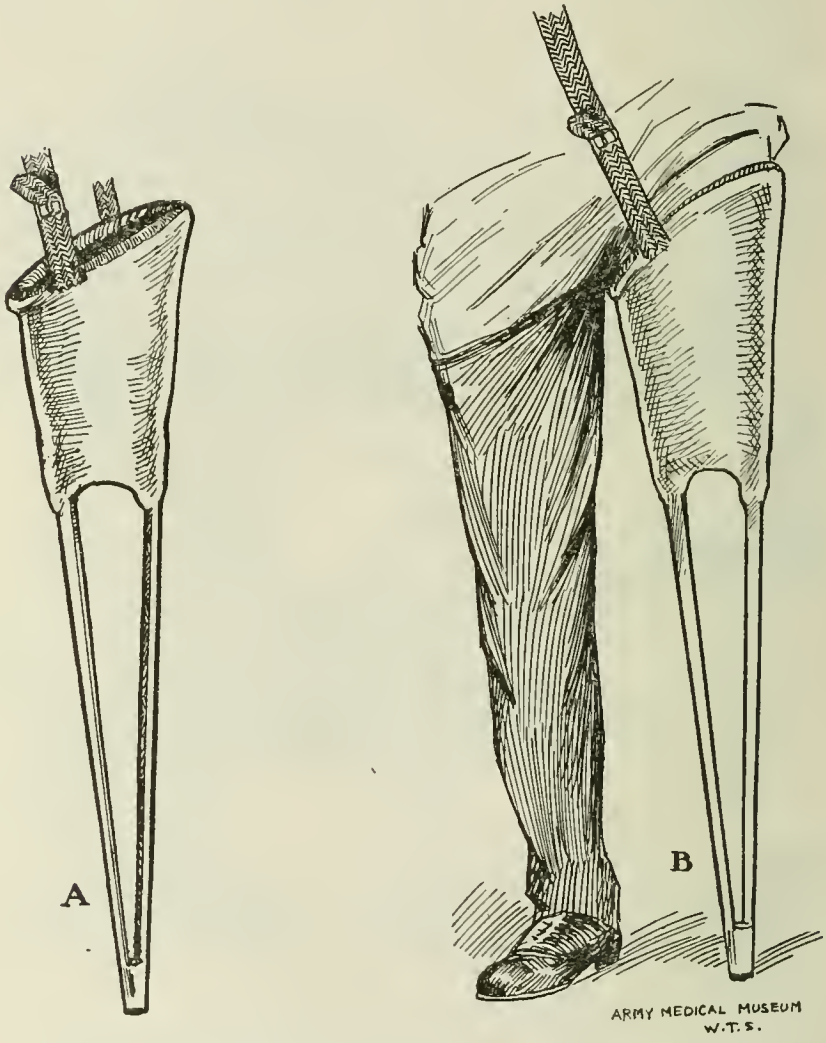


Fig. 5.—A. The Finished Peg-leg. B. The Peg-leg Applied.

parison with the opposite leg. The side bars are then fastened to the socket by two or three plaster bandages and the end of the stump covered in at this time if end bearing is possible.

7. *Finishing the peg-leg.*—When the plaster has set, the peg-leg

is pulled off, any rough edges at the upper circumference of the socket trimmed away and the felt cuff turned down over the upper edge. The peg-leg (Fig. 5A) is then put in a warm place to harden

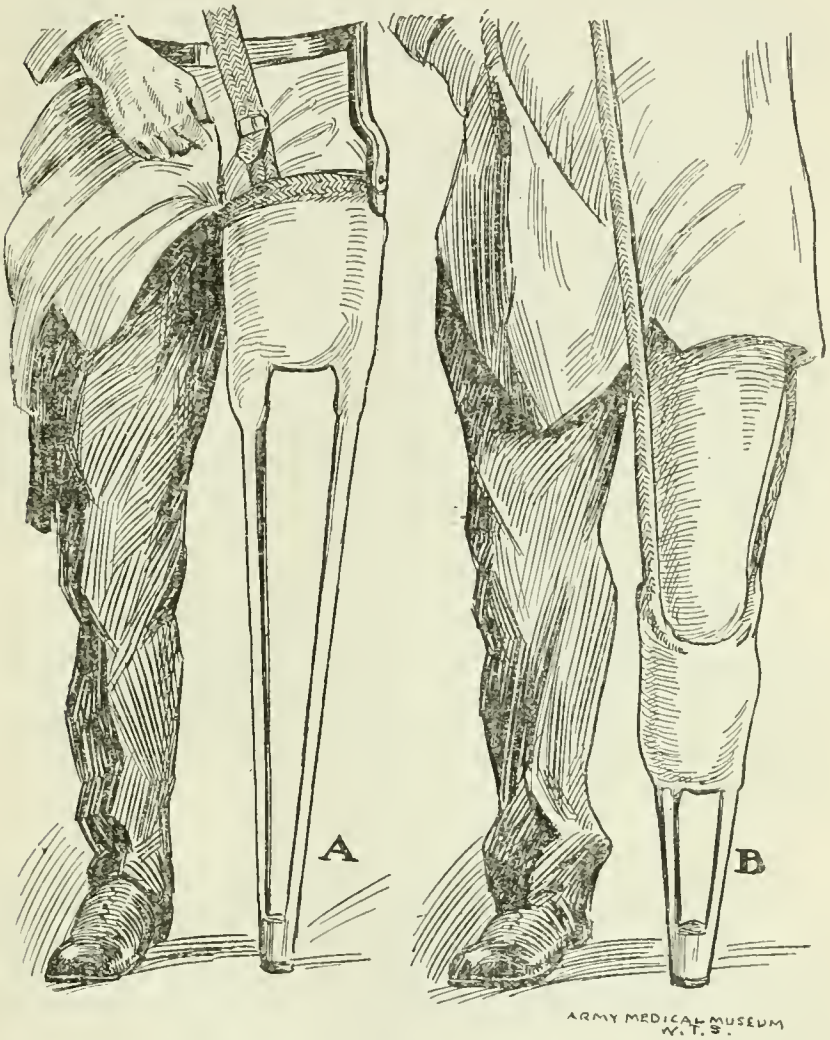


Fig. 6.—A. The Short Peg-leg Provided with a Waist Band. B. Plaster Peg-leg from Amputation below the Knee.

and dry. When the plaster has become thoroughly dried, the felt cuff can be glued to the plaster. It is now ready to wear (Fig. 5B).

Variations.—1. Stock frames can be made by the crutch

method as in Fig. 1F, the side bars being riveted at the lower end, soaked in hot water and held in proper shape until dry.

2. In case of much flexion deformity at the hip, the side bars of the frame may be placed to slant downward and backward in relation to the stump. Use of the stump will tend to stretch out the flexion deformity and a new peg-leg may then be made with the side bars of the frame placed at the proper angle.

3. Short stumps. If the stump is less than 4 inches measured from the perineum, a waist band will be necessary. This is made of 16-gauge steel and consists of a waist piece about 12 inches long, to which at its middle is riveted an upright of the same material. The waist piece is curved to fit the flank on the stump side, and the rest of the circumference of the waist is completed by strap and buckle. The upright is shaped to the outer side of the pelvis. At the level of the hip joint union is made with a short steel side bar by means of a joint allowing antero-posterior, but no lateral, motion. The steel side bar is fastened to the wooden side bar by rivets before the side bars of the peg-leg are incorporated in the plaster. This is actually a "waist" band and is used because it is easier to make. A regular pelvic band is preferable when the necessary time and skill to make and fit it are available.

PLASTER PEG-LEG FOR AMPUTATION BELOW THE KNEE

A similar technique is followed throughout. The plaster is extended up so as to embrace all bony points on the lateral aspects of the knee, but is trimmed away for the patella and the popliteal space. The shoulder straps are placed laterally instead of front and back. In some cases a retaining belt is required at the waist to keep the shoulder straps from shifting (Fig. 6B).

TEMPORARY ARTIFICIAL ARM[3]

Materials.—Clamp and attachments. Flat iron, ½ inch wide and ⅛ inch thick, wing nut and rivet for making the clamp. Iron wire, 3/16 inch in diameter for the hook, and ⅛ inch in diameter for the side grips. Sheet iron, No. 20 gauge for the pencil holder. For working drawings see Fig. 7. When assembled, this makes the stock clamp.

Felt, ¼ inch thick. Plaster bandages, 4 inches wide Webbing, 1 or 1¼ inches wide, and long enough to make a figure-of-8 strap around the elbow. Buckle of a size corresponding to the webbing. Gauze or muslin bandage.

[3]Modified from Daudet.

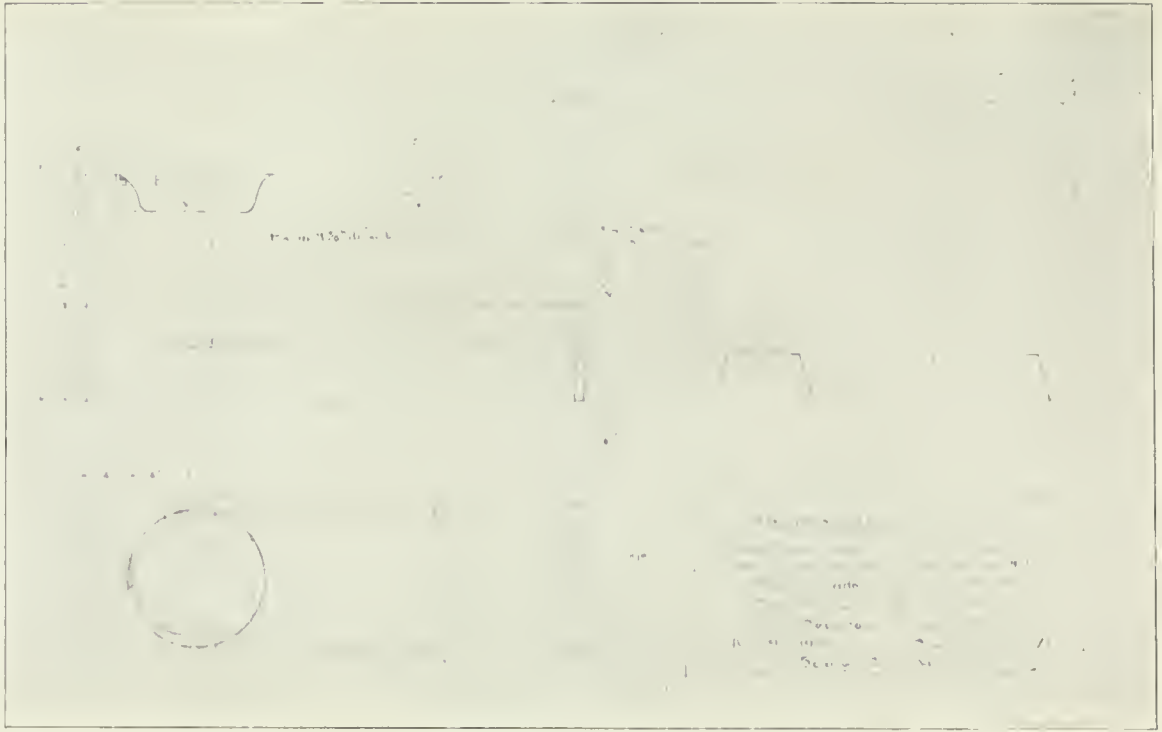


Fig. 1.—Prophylaxis Stool No. 1.

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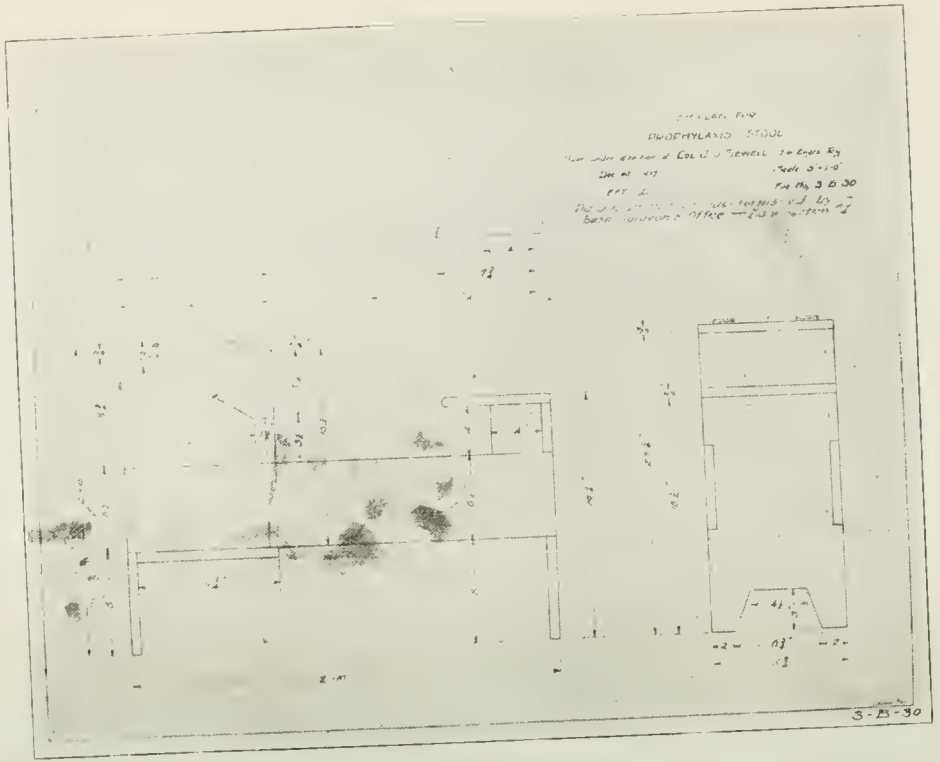

FIG. 2.—PROPHYLAXIS STOOL NO 2.

Construction—(1) *Shaping the felt for the socket.*—This is done in a manner similar to that already described for the peg-leg. The felt should be long enough so that the upper edge of the finished socket will reach to the insertion of the biceps.

2. *Applying the felt socket.*—Also similar to that already described.

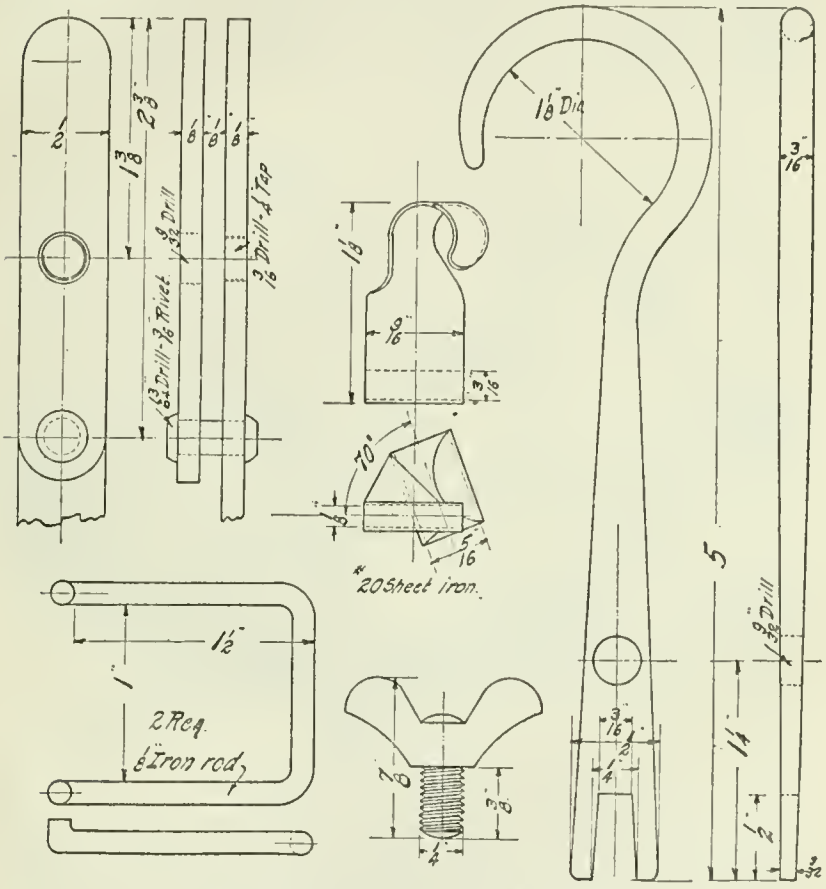

Fig. 7.—Metal Attachments for Temporary Artificial Arm.

3. *Adapting the stock clamp.*—Bend the long bar of the clamp to adapt it to the under surface of the felt-covered stump and so that the wing nut will look upward (Fig. 8). The part of the bar to be incorporated in the plaster should have its surfaces roughened. If used on an upper arm stump, the bar must, of course, be longer and

is bent to a little less than a right angle at a point corresponding to the elbow joint The clamp is now laid aside until needed.

4. *Applying the plaster socket.*—This is also similar to that described for the peg-leg, except that webbing straps are not fastened in the plaster.

5. *Attaching the side grips and the clamp.*—The long bar of the clamp should be placed on the under surface of the socket and held by several turns of the bandage; at the end of the stump a turn may be taken around the bar to fix it more securely. The side grips are similarly incorporated (Fig. 8).

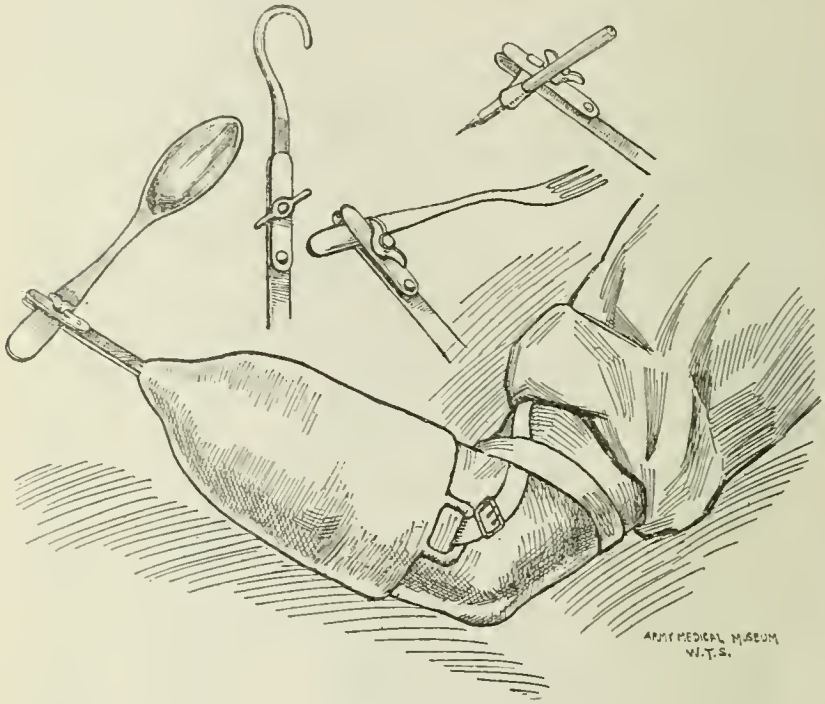

Fig. 8.—Temporary Plaster Artificial Arm.

6. *Finishing the temporary artificial arm.*—The finishing is similar to that of the peg-leg. A short strap and buckle is sewed to the outer side grip and a long strap to the inner.

Use.—Spoon and fork may be placed at any desired angle (Fig. 8). To insert the hook, the wing nut is removed, the hook slipped in until the notched end engages the rivet, and the wing nut then replaced. The pencil holder is clamped in place so that the pencil is to the inner side; it may be twisted to hold the pencil at any angle.

VENEREAL PROPHYLAXIS STOOL

(With two illustrations)

Lieut. Col. Clyde S. Ford, M. C., U. S. A., with our expeditionary forces abroad, has devised an appliance for use in administering venereal prophylaxis which appears to facilitate the procedure. The object sought is: (*a*) To provide a convenient position for the patient which will permit a thorough execution of the different steps of treatment in a most expeditious and complete manner and without soiling the clothing or the surroundings. The box compartment is intended to contain and to protect the material and equipment when not in use and to place them in a convenient position for operation. The height has been determined by the necessity for providing space for a long-necked wine bottle, which is the most convenient container for solutions, to be obtained in France.

(*b*) To provide definite and simple means for bringing the patient and the attendant into formal relation during the procedure of the treatment. It is offered as a sturdy trellis upon which the tender vine of venereal prophylaxis may be hung.

The first model (Fig. 1) was designed for use with a small basin, 9⅜ inches in diameter, which was found to be the regular equipment of prophylaxis units which were first issued at this station. The arrangement for holding this small basin is such that the supports of the seat do not permit the substitution of a basin of other dimensions, so for that reason another model was constructed.

The second model (Fig. 2) is arranged to accommodate a basin of any size, as it does not rest on any special support but may be slipped in on a shelf below the seat.

The dimensions of these models were determined by experiment and experience, as several different types were tried out in arriving at this form.

In the technique of prophylaxis treatment with the employment of this stool, the pan is used only as a catch basin after the first stage of cleansing, which is begun with clean water in the pan, which the patient uses with a gauze or cotton sponge, while the attendant applies, by dropping, a soap solution from a suitable bottle. After this first stage of cleansing is completed, the attendant applies the bichloride solution by dropping from a bottle while the patient does the washing. After the protargol solution is used the rejected fluid is caught in the basin so that all the wastes of the operation are contained in the basin.

CLINICAL AND LABORATORY NOTES

THE EFFECT ON THE LUNGS OF THE INHALATION OF SMOKE FROM CIGARETTES

By Major GERALD B. WEBB, M. R. C.

The opportunity of examining different commands of the United States Army for tuberculosis was used to ascertain, if possible, clinical changes within the chests of those who inhaled the smoke of cigarettes.

It has been commonly observed that cigarette smokers have an irritative cough and there is an impression in the profession, that this is due to throat irritation. Those who have given close attention to diseases of the chest have recognized a cigarette bronchitis.

In auscultation bronchial conditions are usually recognized by the presence of ronchi,[1] at times by the presence of coarse, moist râles. Bronchial ronchi are heard best, coincident with the cough of the subject undergoing examination, and not with inspiration or expiration. Such ronchi can best be heard over the lung roots, along the sternal margins, in the interscapula region and also in the axillae. The men were instructed to breathe in moderately, then breathe out and give a short, sharp cough. These ronchi were listened for in over 3,000 soldiers and are tabulated below, their presence or absence being noted as indicated. A record was also kept as to the soldier's preference in regard to tobacco, and this is listed in the table.

There can be no doubt that the inhalation from cigarettes produces a bronchial irritation which is revealed by the detection of ronchi. The table shows clearly that in the majority of cigarette smokers bronchial ronchi are present, whereas in the majority of non-smokers, pipe smokers and cigar smokers no evidence of such is observable. Slight catarrhal cold epidemics occurred during these investigations, but soldiers acknowledging such are not included in these figures. It is possible, however, that such unrecognized conditions may have placed the percentage of non-smokers with ronchi a little too high.

In addition to ronchi, medium and coarse râles were observed in many heavy cigarette smokers. These rales would usually disappear after several coughs. Occasionally a very quiet vesicular murmur was observed.

Many tuberculosis specialists absolutely forbid cigarette smoking by their patients. We recall the dismay of Dr. Trudeau over his celebrated patient, Stevenson, an inveterate cigarette smoker,

[1]The term ronchus is used as equivalent to that of indeterminate râle, sibilant râle or bronchial râle.

and who, by the way, according to Stevenson's biography, overcame his tuberculous condition and finally died of apoplexy. It has been noted that coal miners who get their lungs chocked with coal dust, and who may even suffer to a certain extent from pulmonary fibrosis, are even less liable to die of pulmonary tuberculosis than most men.

Corbett, in his "Causes of Tuberculosis,"[2] also notes that experience had shown that in the old underground railway system of London, before the trains were electrified, certain stations notorious for their mephitic vapors were selected as of value to the consumptive employes. Italians have observed that sulphur has retarded the development of tuberculosis.

Regarding the soldiers who were found tuberculous and deemed unfit for service by the writer and his coworkers in War Department Tuberculosis Boards, the table shows that a somewhat larger percentage of non-smokers was discharged than of smokers.

If we add to the non-smokers those who did not inhale and who therefore did not produce irritative ronchi—namely, the pipe and cigar smokers—we then note the observation that 30 per cent of soldiers discharged for pulmonary tuberculosis (233) did not inhale from cigarettes.

These studies would at least suggest that the inhalation of the smoke of cigarettes does not aid in the outbreak of pulmonary tuberculosis. It was noticed by Surgeon O. M. Gilbert that in general the heart rate, after lung examinations, did not become so accelerated in cigarette smokers as it did in pipe and cigar smokers.

Ronchi Production in 2632 Smokers and 656 Non-Smokers Examined

	Fine ronchi	Medium ronchi	Coarse ronchi	Negative	Without ronchi	Discharged for Tuberculosis
	No.	No.	No.	No.	*Per Cent*	No.
Non-smokers	172	5	0	479	73	51
Smokers: Using						
No. I.—Light	43	36	2	17	17	
Tobacco Medium	211	91	4	52	14	30
Heavy	112	67	6	18	9	
No. II.—Light	26	3	0	17	36	
Tobacco Medium	132	22	1	64	29	16
Heavy	20	18	2	18	30	
No. III.—Light	70	2	0	63	46	
Tobacco Medium	367	87	0	273	38	16
Heavy	358	55	2	93	18	
Pipe	67	5	0	52	41	13
Cigars—Medium	63	0	0	70	53	70
Heavy	11	0	0	12	52	

[2]Cobbett: The Causes of Tuberculosis; Cambridge, 1917.

A PYOGENIC DIPLOCOCCUS FOUND IN SKIN INFECTIONS IN A MILITARY HOSPITAL IN FRANCE[1]

By Captain EDWARD B. KRUMBHAAR
Medical Reserve Corps, U. S. Army

In various skin infections and infected gunshot wounds, we have found on various occasions during the past six months a diplococcus in aparently pure culture that does not seem to correspond with any coccus described in text-books, as far as limited opportunities for search will allow. In smears from pus and in earlier cultures it is partially or wholly decolorized by Gram's method, so that, on account of its possible occurrence in the spinal fluid in cases of traumatic meningitis, it must be recognized as distinct from the meningococcus. In one case of gunshot wound of the spine, in fact, it was cultivated from the spinal meninges at autopsy, but was differentiated from the meningococcus by agglutination tests as well as the differing sugar actions. A somewhat similar coccus has recently been reported by MacCormac[2] in cases of ecthyma.

The diplococcus in question was first grown from an infected scratch on the finger of one of the workers in the laboratory, shortly after our arrival here in June. In spite of ordinary antiseptic dressing, the infection persisted for over a week, with a tendency to burrow under the skin at the periphery of the infected area. Before its disappearance this produced a slightly raised, rather vesicular circle, with a healing center. During the next two weeks similar infections occurred in scratches on three other fingers, all containing the same Gram negative diplococcus. Since that time an apparently identical organism has been obtained in another hand infection and in various smears and cultures from infected gunshot wound. If it should eventually prove to be a new variety, the name Cuticoccus (or Diplococcus Cutis) is suggested.

Characteristics.—In smears from pus the Gram negative organism has been found mostly in pairs and more often intracellular than extracellular. It may occur, however, singly or in very short chains. The individuals are fairly uniform in size, about the size of *S. aureus,* and either spherical or slightly flattened on adjacent sides.

The organism grows readily, but not luxuriantly, on plain agar slants, with a characteristic moist, milky white, opaque growth, tending to discrete round colonies. When confluent the borders of

[1]Read before the American Red Cross Research Society, Paris, January 14, 1918.
[2]MacCormac: "Skin Diseases and Their Treatment Under War Conditions," Proc. Ry. Medical Society, 1917, Vol. x, p. 121.

the streak are smooth or wavy. Subcultures grow more readily on agar than does the original material from pus. The texture of the growth is homogeneous and slightly translucent under low magnification. In smears from the agar slant, like meningococci, the cocci show more variation in size and the larger organisms tend to retain more of the Gram stain. The more the organism is subcultured the more positive it becomes to Gram staining, although old cultures lose this characteristic more quickly than ordinary cocci.

The arrangement in pairs is more frequently to be found than in the agar slant and the variations in size are greater. There is also some tendency to short chain formation. The organism grows best aerobically at incubator temperature (37.5° C.). At room temperature (15 to 25° C.) growth is slight, but under anaerobic conditions growth is almost as great as aerobically. It produces neither gas nor indol, but is a strong acid former in glucose and maltose broth, less so in saccharose and lactose, and only forming acid in mannite broth occasionally or after several days' incubation. Litmus milk is slowly decolorized or acidified and sometimes partly coagulated. Growth on potato is either absent or very scanty as a faint chalky white band heavier at the edges than in the center. In the scantier growths it is more apparent near the drier top of the slant. Growth on glucose egg slants is richer and at times slightly cream-colored or yellowish. In plain broth, cloudiness with a flocculent sediment is produced. Gelatin is not liquefied, but there is a scanty growth of fine white points on the surface and along the stab. The vitality of the organism has not been determined further than by the observation that the majority of strains tested have remained alive on agar for over two months. Opportunity has not been afforded to test out its virulence. A few salt solution emulsions of fresh subcultures, however, on agar failed to cause suppuration when injected subcutaneously or intramuscularly or to kill after intravenous or intraperitoneal injection.

It is perhaps worth noting that during the routine examination of diarrheic stools, somewhat similar colonies were occasionally found on plates of McConkey medium. They did not have the same milky appearance, however, on subculture, and smears showed Gram negative cocci, but with a distinctly greater tendency to chain formation. No further relationship between these organisms, or the pathogenicity of those from the intestine, was demonstrated or even investigated. With the advent of cooler weather they have disappeared from stools now being examined.

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VOL. XLII MAY, 1918 NUMBER 5

ORIGINAL ARTICLES

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GUNSHOT FRACTURES OF THE LONG BONES OF THE EXTREMITIES

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(With twenty-nine illustrations)

(*Continued from March issue*)

BONE INFECTION.—The infection of bone, with a single exception, may be summed up in the one word—osteomyelitis. The exception concerns the occasional cases of abscess formation in subperiosteal hematomata in which there is no involvement of the marrow. It is practically an infection of the soft tissues and yields readily to treatment. A type of osteomyelitis, which quite resembles in its acute onset and obstinacy those cases seen in civil practice, develops by the extension of infection to the bone marrow through fissures complicating contusions or shallow grooves. There is the usual development of pain and bone tenderness, with fever and leucocytosis. If proper drainage is not provided, the process may become extensive. Another type complicates the deeper grooves. In these the marrow is exposed, readily becoming infected. As a result of the greater drainage which the groove provides, the process tends to be limited, resembling in its later stages a pocket abscess of the marrow (Fig. 6, p. 308e).

In the penetrating and perforating incomplete fractures, infection of the marrow is the rule. Its extent depends roughly upon the size of the missile and the promptitude or tardiness of operative procedures for drainage. With very small missiles the area of primary infection is quite limited. The bone apertures, however, are likewise small, affording incomplete drainage, and, if not properly enlarged, may permit of a subsequent extensive marrow infection. The larger missiles, by their increased violence, destroy more of the marrow and cause a more extensive primary infection but, as they also produce larger apertures and hence better drainage, the process tends to remain localized until

such a time as the soft tissues contract and obstruct the discharge of pus.

In the complete fractures, the extent of the osteomyelitis will vary according to the degree of comminution and the presence or absence of long fissures. The greater the comminution, the more numerous will be the fragments and the greater the extent of the marrow exposed, with this exception—in those cases where the velocity of the missile is so great that most of the fragments are borne away (Fig. 1), the infection will be limited to the exposed ends of the upper and lower fragments. Thus in the simpler contact fractures a lesser degree of infection results than in the severe comminutions. If, however, in the simplest contact fracture accessory longitudinal fissures have appeared, the extension of infection along these to healthy marrow may result in a widespread osteomyelitis. Such fissures may likewise exacerbate the infection of comminuted fractures.

As already indicated, bone infection is much more resistant than that of the soft parts. Under the older methods of treatment the usual evolution was towards chronicity, with sequestration and sinus formation, leading often to septicemia. Even with the improved methods of treatment it takes much longer to sterilize bone than soft tissue.

Before leaving the discussion of infection, it will be well to consider a comparatively late phenomenon in the history of infected wounds—the so-called latent infection. As the wound granulates and cicatrizes, infectious organisms are sequestrated in the scar tissue, retaining their vitality for many weeks. Any operative or manipulative interference, even with a healed and innocent-looking wound, may release these organisms or stimulate them to renewed activity. It is a common experience, when operating with the strictest asepsis through the scar of a wound that has been healed for several weeks, to have a virulent infection arise within 24 to 36 hours. Moreover, upon attempting active or passive motions in a limb containing an encapsulated foreign body, an abscess frequently develops. In this hospital latent infection of all three types have occurred: pyogenic, gaseous and tetanic.

Under the older methods of treatment, the usual rule was to wait three months before attempting corrective operative procedures. This was not so necessary in those wounds which had been several months in healing and for a good portion of that period had consisted of a sinus leading to the bone. In such wounds the encapsulated organisms would have been devitalized. Under these conditions operative procedures might be carried out within six weeks. Under the more recent methods of treatment, as will be shown later, the danger of latent sepsis is largely obviated.

Treatment of Infection.—In this section the treatment of the pyogenic infections of soft parts and that of bone infections will be considered together, inasmuch as they are carried out conjointly. Later, the treatment of the anaerobic infections will be discussed.

It has been amply proved during the present war that the sooner gunshot wounds are explored and cleansed the less likelihood there will be of development of infection, or if it does develop, the less severe will be its nature. This is quite true of gunshot fractures. The most favorable time for operative interference, if it is indicated by the nature of the wound, is within the first 12 to 24 hours; and the sooner, the better. At this stage the organisms are few and scattered, and with appropriate treatment can be destroyed, permitting an early closure of the fracture without development of infection. This, however, would involve the dressing and clearing stations in such an increased amount of labor that it has not been universally adopted. The result is that by the time the cases reach the field and base hospitals, inflammation has begun and prophylactic treatment is no longer feasible. In the early months of this war, the customary method of treatment was to provide for ample drainage and rely upon the tissues to overcome the infection. Subsequently, methods of assisting the tissues in their struggle with infection were elaborated which require a different technique. I shall touch first upon the system of drainage and consider afterward the methods of sterilization.

As regards the advisability or inadvisability of early operative interference in compound fractures, there is a certain type in which it is wise to postpone exploration until the development of infection has become definitely established. The fracture, whether incomplete or complete, is generally of a simple nature. The external wounds, both of entry and exit, are small, becoming quickly healed and preventing the extension of infection inward from the skin. They should be treated with iodine or picric acid and protected by dry dressings. In many instances these fractures will show no clinical signs of infection, the tissues being able to destroy the few organisms which have been introduced by the missile. Their treatment becomes identical with that of a simple fracture. They represent the bulk of the non-infected fractures, which, as admitted to this hospital, have comprised 23.1 per cent of all compound long-bone fractures. They are generally caused by undeflected bullets of reduced velocity, occasionally by shell fragments and shrapnel. The percentage of the various missiles has been: bullet, 73.6 per cent; shell, 15.7 per cent; shrapnel, 10.6 per cent. The following case is a type of the healing of non-infected fractures:

Pte. A. J. S., 12th East Surreys Perforating bullet wound of left arm June 7, entering antero-external aspect of lower third, leaving posterior aspect at same level. Non-infected compound fracture lower third humerus, comminuted, complete (Fig. 37). Admitted A. W. W. H., June 14. Skin wounds contour, practically healed. No union. No nerve involvement. July 1, beginning union. Wounds healed. No symptoms. July 20, Union firm. Massage and passive motions. Aug. 24, Discharged to duty. Elbow movements normal save for five degrees limitation of extension. Forearm and hand normal. Strength good. Duration of treatment, seventy-eight days.

In many such cases, however, localized signs of inflammation will develop and the skin wounds will begin to discharge. Immediate exploration is indicated. If the inflammation is acute, extensive surgical interference should not be attempted, inasmuch as the necessary exposure of fresh tissues might lead to an extensive infection. One should be content with the removal of foreign bodies along the track and with adequate drainage. After the inflammation has subsided, if continued suppuration makes it evident that foci of infection yet remain, more extensive exploration may be safely undertaken. Necrotic muscle and fascia should be excised, previously overlooked foreign bodies removed, and the focus of fracture treated along lines that will be discussed later.

Fractures of this type, even after inflammatory reaction becomes evident, may seem quite innocent. If treated by conservative methods—that is, by drainage through the skin wounds and hot fomentations—they might heal after a rather prolonged suppuration. Their convalescent period, however, would be far greater than in the case of early operative interference. Moreover, the surgeon may at times be grossly deceived by the appearance of such wounds, particularly when situated in the thick muscles of thigh or calf. Not uncommonly one finds a considerable cavity, with walls of lacerated muscle, filled with bloodclot. The simple contour wounds and slight purulent discharge offer no indication of the condition. It is in effect an internal explosive wound, in which the bone fragments, propelled outward as secondary projectiles, have been checked by the resistance of muscles and fascia, while the missile has lodged or passed out of the limb.

With the more extensively lacerated wounds, early exploration is indicated. If the inflammation is acute it should be limited, merely providing for efficient drainage and the removal of the more accessible foreign bodies. As soon as the inflammation has subsided, more extensive measures will become necessary.

Operative Treatment of Bone.—As already indicated, certain types of fractures heal aseptically and require no interference. Infected

fractures, however, require early operative treatment. This varies according to the nature of the infection. If the process develops in an infected subperiosteal hematoma, simple incision and drainage will suffice. In the case of osteomyelitis developing through fissures, trephining of the bone over the site of the infection will be necessary, with adequate subsequent drainage or sterilization. With osteomyelitis complicating the deeper grooves it is necessary to explore the groove by a generous incision, enlarge it, and remove by curettage the infected marrow. Thereupon one must either sterilize the wound in a manner to be indicated later or keep it well packed with gauze, allowing it to granulate from the bottom outwards. The frequent mistake of not sufficiently enlarging the groove in the cortex or of allowing the soft parts to contract and obscure the bone cavity should be carefully avoided. If such mistakes are made it means a future operation, whereas when avoided, the original operation will suffice.

With the fragmented fractures, particularly if complete, a fresh principle is involved, namely, the advisability or inadvisability of the removal of the bone fragments. It is generally recognized, but not, unfortunately, so generally practiced, that extreme conservatism should be observed in their removal. Too much stress cannot be laid upon this principle. Even today fractures are received in base hospitals in which the fragments have been so indiscriminately removed that nonunion results. In the incomplete fractures, the question is not of such vital importance. The removal of fragments with the infected bone marrow may be necessary for a thorough exposure of the wound and will not endanger the continuity of the bone. In complete fractures, however, every adherent fragment should be left undisturbed. Fragments undoubtedly loose may be removed if they are small, for it is their usual fate to lose their periosteum and necrose in the presence of infection. They then act as foreign bodies, prolonging suppuration. If, however, the fragment is larger and there is doubt as to its prospects of living, it should be left in place, running the risk of a necessary subsequent operation for its removal. Some operators even remove the loose fragments, cleanse them and return them to the bone focus, in the hope that they will live and assist in union.

As already indicated, the treatment may be along the lines of drainage or of attempts at rapid sterilization. As far as drainage is concerned, certain principles are necessary. All incisions and counter-incisions must be of ample size, too large rather than too small. Nothing distresses one so much as to see foci of infection drained through inch incisions, well blocked by gauze or other drainage material. Counter-incisions must be so placed as to assure dependent drainage. Otherwise

the pus will form in pools and pockets, tending to burrow along fascial clefts, with constant systemic absorption. This gravitation tendency is very marked in limbs raised in suspension apparatus, and consequently the surgeon must place his incisions with a view to the position of the limb when in apparatus. All fascial clefts must be explored and drained dependently, by special incisions if required. Care must be taken to avoid nerve trunks, for, as will be seen later, they may become involved in the resulting scar. Considerable discretion must be employed in the selection of drainage material. Gauze may be often necessary to check hemorrhage but should never be left in the wound longer than forty-eight hours, as it becomes soaked and, acting as a plug, obstructs the discharge of pus. Soft rubber and gutta-percha tissue are excellent, as they are easily introduced into the clefts, are not stiff enough to cause pain from pressure upon the inflamed tissues, and are easily replaced. Rubber tubing, if soft, may be very useful, as it tends to prevent the soft tissues from contracting and obstructing drainage. I consider it inadvisable to use stiff rubber tubing, as it not only causes pain from pressure, but is very dangerous in the neighborhood of blood vessels. It is not uncommon for it to press upon an artery and produce an ulceration, with secondary hemorrhage. The following is a case in point:

Pte. J. K., 16th Batt., Welsh Regt. Non-perforating grenade wound of thigh, March 30, at Givenchy. Incision and drainage with removal of grenade fragment, March 31. Admitted A. W. W. H., April 7. Presented a laterally through and through wound of lower third thigh, posterior to vessels, anterior to hamstring tendons. Knee acutely flexed. A hard rubber tube extending completely through. Wound infected. The tube was removed and rubber drain inserted. April 11—Plaster applied under anesthesia to correct contractures. Wound orifices curetted. Popliteal artery felt pulsating in the wound. Drain inserted from either side. April 18—Slight hemorrhage. April 20—Severe hemorrhage. Operated immediately. Median incision through popliteal space. A small erosion found on posterior aspect of popliteal artery where drainage tube had impinged. Artery ligated above and below erosion. April 22—Two areas of ecchymosis on inner aspect of leg along course of internal saphenous vein. April 25—A large bleb with bloody contents has developed in ecchymotic areas, extending to ankle. April 28—Tissues beneath bleb have sloughed: cut away without pain. A belt of gangrene 2 inches wide from lower margin of popliteal space along postero-internal aspect of calf to ankle, involving calf muscles and Achillis tendon (Fig. 38). May 5—Wound granulating cleanly.

During the next five months the wound was skin-grafted three times. On October 25 the wound was nearly healed and a tenotomy was done for equinus (Fig. 39). Patient discharged from service April 17, 1917, able to walk about 50 yards.

If osteomyelitis is treated by drainage, one should endeavor, wherever possible, to procure and maintain an ample exposure of the bone cavity, pack it frequently clear to the bottom, and make certain that it heals by granulation outward with the occlusion of all the bone recesses. This is comparatively easy to do in fractures of tibia, radius, ulna and certain portions of humerus and fibula, but has its difficulties otherwise. At its best it is a slow process. Personally, I prefer to treat infection by sterilization methods, which I have found much quicker and productive of less cicatricial formation.

Two of the methods of sterilization evolved during this war depend upon a liquid agent having, in the one case, a physiological action, in the other an antiseptic. They are the methods of Wright and Carrel. The third method depends upon the action of antiseptics applied in the form of a paste and was elaborated by Morison.

The first method presupposes the uselessness of antiseptics in an infected wound, from the logical inability of such an agent to penetrate the tissues and reach the bacteria lodged there, from the well-known fact that practically all efficient antiseptics either are soon neutralized by the proteids of wound secretions or damage the tissues, and from the negative results of the use of antiseptics in the earlier treatment of war wounds. Arguing from these premises, Sir A. E. Wright presented in 1915 a treatment of wounds based upon the physiological effects of salt solution. His course of treatment may be divided into three distinct stages.

In the first stage he instituted, by various methods, a continuous irrigation of hypertonic saline solution. He fixed upon a 5 per cent solution as the best. Greater concentration caused severe pain and skin irritation, while saturated solutions even produced escharotic effects. A three-fold action was claimed: first, an inhibitive effect upon the growth of bacteria; second, the release of a digestive ferment by the breaking up of leucocytes which, acting upon the sloughing tissues, resulted in rapid auto-digestion and removal; third, an increased outward flow of lymph, combating the tendency of bacteria to spread into the tissues along the lymphatics, favoring their extrusion into the wound, thus preventing or relieving the inflammatory induration of adjacent tissues.

With the relief of inflammation and the development of a cleanly granulating wound surface, the second stage began, consisting of the substitution of normal saline solution for the hypertonic. This caused an increased progression of leucocytes into the wound, covering its surface with a white film. The bacteria, it was claimed, were ingested and the infection not only prevented from spreading again into the tissues but gradually destroyed on the wound surfaces.

Having reached the point of sterility, the final stage consisted of the occlusion of the wound by suture, strapping or pressure, with the expectation of healing by first intention.

The second method, elaborated in 1915 by Carrel and so clearly explained in his book (10), is dependent upon the antiseptic action of the agent. This method has been so well described in various journals that I shall not attempt to give it in detail, but merely touch upon its more important points as regards the treatment of fractures.

The agent used is an isotonic solution of hypochlorite of soda, familarly known as Dakin's solution, possessing a high degree of antiseptic power in the presence of tissue proteids. It is used in a concentration of 0.45 per cent to 0.50 per cent, a lesser concentration having inadequate antiseptic properties whereas a greater has irritant effects upon the tissues. It is prepared, according to Daufresne's modification, by the mixture of chloride of lime (containing 25 per cent active chlorine), 184 gms.; anhydrous carbonate of soda, 92 gms.; and bicarbonate of soda, 76 gms. The result is a hypochlorite of soda content of 0.475 per cent. To increase the stability of the solution, 5 mg. of potassium permanganate per liter are added. It deteriorates rapidly, necessitating careful control by titration if kept for several days. It is conducted from a reservoir to the wound through various arrangements of rubber tubing. In contact with a wound it undergoes rapid diminution in concentration through dilution by the wound discharges and through the reduction of the sodium hypochlorite by combination with proteids. Holding clearly in mind that the primary object is not to flush away the septic discharges but to keep continuously in contact with the wound surfaces an antiseptic solution maintained as nearly as possible at a certain concentration, two methods of instillation have been found adequate: first, the continuous drip, applicable to cup-shaped wounds; and second, flushing at intervals not exceeding two hours.

In Carrel's experience this method has shown most rapid results in wounds of the pre-inflammatory stage. In this period extensive surgical interference can be carried out with little danger of spreading the infection. With careful removal of foreign bodies and excision of lacerated tissues, followed by the proper instillation of Dakin's solution, early wounds are rapidly sterilized and may be closed in the confident expectation of healing by first intention. He claims that early compound fractures may be closed in two weeks. In the inflammatory period he advises merely the necessary amount of interference to establish proper drainage, then instilling the antiseptic and applying hot ferments locally if indicated. After the inflammation has subsided,

FIG. 14.—IRREGULAR PENETRATING FRACTURE TIBIA. A SMASH WITH MISSILE LYING AMONG THE FRAGMENTS.

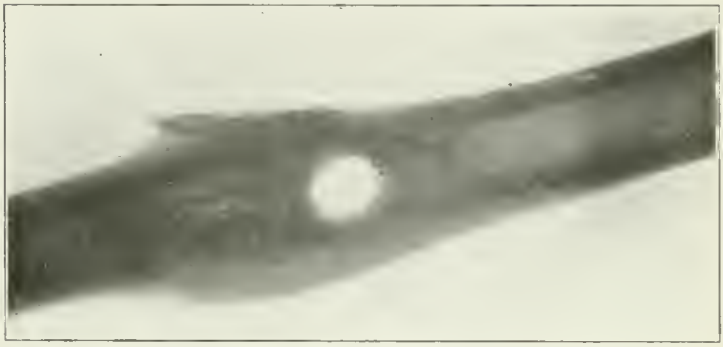

FIG. 15.—OLD PERFORATING FRACTURE OF HUMERUS. BULLET.

FIG. 16.—COMPLETE PERFORATING FRACTURE TIBIA, WITH SURPRISINGLY LITTLE COMMINUTION. BULLET AT MEDIUM RANGE.

(To face page 512.)

FIG. 17.—"WEDGE-SHAPED" FRACTURE OF TIBIA. MARKED COMMINUTION AT SITE OF IMPACT OF MISSILE. AN ECCENTRIC PERFORATION.

FIG. 18.—COMPOUND FRACTURE TIBIA. PENETRATING SHELL. IRREGULAR FRAGMENTATION, WITH TENDENCY TOWARDS "WEDGE-SHAPED" TYPE.

FIG. 19.—COMMINUTED FRACTURE OF HUMERUS, "WEDGE-SHAPED," WITH COMMINUTION OF LATERAL FRAGMENT.

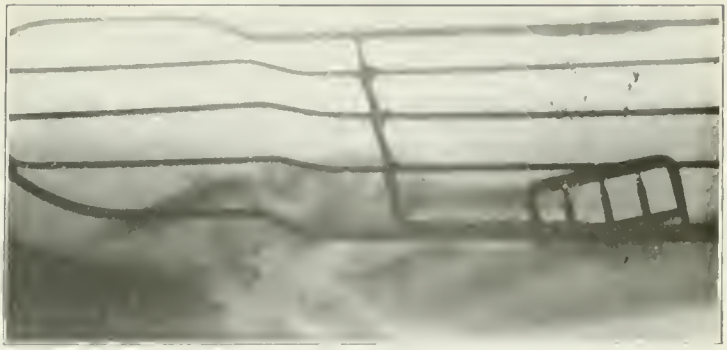

FIG. 20.—PERFORATING FRACTURE HUMERUS. EXCESSIVE AND IRREGULAR FRAGMENTATION. PARTIAL DISINTEGRATION OF MISSILE.

FIG. 21.—ILLUSTRATING EXCESSIVE LOSS OF SUBSTANCE OF HUMERUS FROM COMMINUTION AND INFECTION.

FIG. 22.—COMPOUND FRACTURE OF HEAD OF HUMERUS. A TYPE OF FRACTURE IN WHICH HEAD OF HUMERUS IS APT TO BECOME NECROTIC THROUGH DESTRUCTION OF BLOOD-SUPPLY AND INFECTION.

Fig. 23.—Perforating Fracture of Femur with Excessive Comminution and Propulsion of Fragments.

Fig. 24.—Comminuted Fracture of Femur with Marked Displacement of Lower Fragment.

Fig. 25.—Compound Fracture of Tibia, with Indirect Fracture of Fibula.

FIG. 26.—DIRECT FRACTURE OF RADIUS, PERFORATING, WITH PROPULSION OF BONE FRAGMENTS. INDIRECT FRACTURE OF ULNA.

FIG. 27.—COMPOUND FRACTURE OF HUMERUS, ILLUSTRATING DISINTEGRATION OF BULLET AND PROPULSION OF BONE FRAGMENTS ALONG TRACK OF MISSILE.

FIG. 28.—FRACTURE OF ULNA FROM DISINTEGRATED BULLET.

FIG. 29.—FRACTURE OF HUMERUS, CONTACT; FROM DISINTEGRATED SHRAPNEL BALL.

FIG. 30.—FRACTURE OF RADIUS FROM SHRAPNEL BALL. PARTIAL DISINTEGRATION.

FIG. 31.—EXTREMELY COMMINUTED FRACTURE OF FEMUR.
Note propulsion of fragments.

FIG. 32.—DIRECT FRACTURE BOTH BONES OF LEG, ILLUSTRATING PROPULSIVE EFFECTS.

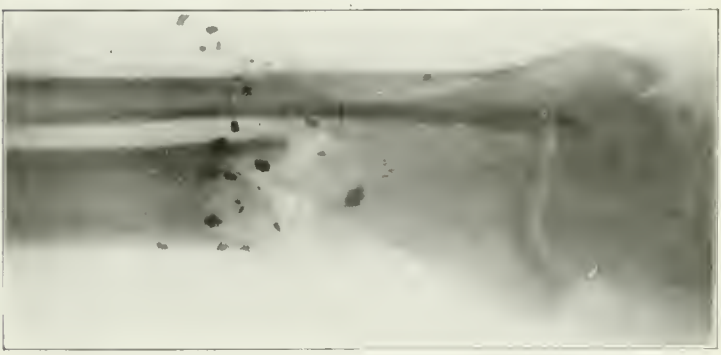

FIG. 33.—FRACTURE OF TIBIA FROM GRENADE.
Note smallness and multiplicity of fragments.

FIG. 34.—PENETRATION OF HEAD OF FEMUR BY UNDEFLECTED BULLET AT LONG RANGE. INCOMPLETE FRACTURE. MORE APT TO HAPPEN IN THE CANCELLOUS PORTIONS THAN IN DIAPHYSIS.

FIG. 35.—COMPOUND FRACTURE OF HEAD OF FEMUR. BULLET. A TYPE OF FRACTURE IN WHICH THE HEAD IS APT TO NECROSE FROM LOSS OF BLOOD-SUPPLY IN THE PRESENCE OF INFECTION.

FIG. 36.—COMPOUND FRACTURE OF NECK OF FEMUR.

FIG. 37.—COMPLETE PERFORATING FRACTURE OF HUMERUS, WITH PROPULSION OF BONE FRAGMENTS. NON-INFECTED. UNUSUAL TO AVOID INFECTION WITH SO MUCH COMMINUTION.

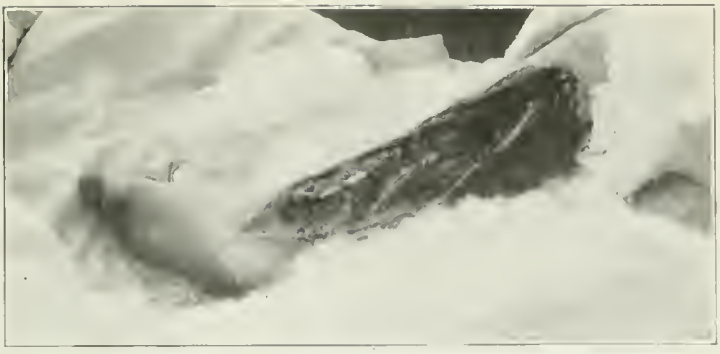

FIG. 38.—GANGRENE OF LEG FOLLOWING LIGATURE OF POPLITEAL ARTERY FOR SECONDARY HEMORRHAGE, DUE TO EROSION BY HARD RUBBER TUBE.

FIG. 39.—CONDITION OF LEG BEFORE TENOTOMY. MARKED EQUINUS. SLIGHT CONTRACTURE OF KNEE.

FIG. 40.—FRACTURED RADIUS, WITH EXPLOSIVE DORSAL WOUND.

Anterior skin wound encouraged to heal quickly, making the track through the tissues watertight. The pool of Dakin's solution distinct. Most favorable for quick sterilization.

FIG. 41.—GAS GANGRENE OF LEG FOLLOWING SECONDARY HEMORRHAGE.

FIG. 42.—GAS GANGRENE OF LEG, SHOWING DISCOLORATION AND BLEB FORMATION.

if the wound continues suppurating, careful surgical cleansing through generous incisions can be done with impunity. For wounds in the suppurative stages, his technique consists of a careful exploration and subsequent instillation.

This method requires painstaking surgical technique and arrangement of the instillation tubes and strict asepsis in subsequent dressings, with particular care to keep the adjacent skin surface as sterile as possible; a method most adaptable to a well-staffed base hospital. The progress of sterilization is observed by the rough, but sufficient, method of counting the bacteria of the wound discharged from smears of as uniform a thickness as possible and in fields of uniform size. If the number of bacteria decreases to less than one per five fields and continues thus for several days, the wound may be considered sufficiently sterile for occlusion. If the count cannot be reduced to this level, a focus of infection is indicated which must be removed.

The third method was elaborated by Morison and consists of the use of a paste made up of one part bismuth subnitrate and two parts iodoform, with sufficient liquid paraffin to acquire the desired consistency. It is claimed that this paste, familiarly known as "Bipp," will sterilize compound fractures, permitting of their early closure and treatment as simple fractures. The technique demands a careful surgical cleansing, followed by application of the paste and closure of the wound of the soft parts by sutures or strapping. The after care is very simple, requiring dressings at least only once a week. It thus obviates frequent painful dressings and, if generally used, permits of a much smaller nursing staff.

In common with the majority of surgeons in 1915, I depended upon the older method of efficient drainage. The result was prolonged convalescence, especially in the more severe fractures, with successive operations for recurring abscesses and obstinate sinus formations, and with the production of excessive amounts of scar tissue and indifferent end results. Eventually I tried the hypertonic saline treatment. It produced a great improvement in the evolution of flesh wounds, but proved inefficient in sterilizing compound fractures. In some cases its irritant effects were marked. I then tried Carrel's method and, later, Morison's. At present I use them in conjunction.

Most of the fractures as admitted to this hospital are in the inflammatory or suppurative stages. If in the former, and if the wound seems to have adequate drainage, I begin at once the instillation of Dakin's solution, which is generally possible without anesthesia, and treat the adjacent inflammation with hot fomentations. If the wound is not draining properly, it is enlarged under primary or gas anesthesia,

the track superficially examined for foreign bodies, and the tubes for instillation inserted. No attempt at an extensive cleansing is made; it would involve the exposure of fresh tissues and a possible dangerous spreading of the infection. Within a few days the inflammation will subside and the infection become limited to the track of the wound. With some of the lesser bone injuries, such as contusions and grooves, this is all the treatment required. The wound will gradually become sterilized and may be closed. But with those fractures involving the bone marrow, sterilization will not as a rule become complete. The bacterial count may diminish to five or ten per field and persist at that level with occasional upward bounds to fifty and seventy per field or infinity. With such fractures, if one were to wait to see if they would become sterile, this would indicate the necessity of further surgical intervention. However, it is unwise to wait, for not only will the fracture remain infected, but much valuable time will be lost.

As soon as the inflammation has subsided the track of the wound is laid open through a generous incision. There is no objection to making extensive incisions, for not only will the subsequent application of sodium hypochlorite prevent the freshly exposed tissues from becoming infected, but the incision itself may be closed in a short time, healing as if it were primarily sutured. On the other hand, there is the advantage of being able to see the whole course of the wound and of making certain that it is properly cleaned. All foreign bodies are removed. Necrotic muscle, fascia and tendon are removed by sharp dissection. The wound should never be curretted, either with instrument or gauze; the method is not only incomplete but traumatizing. The focus of fracture is carefully examined. The non-adherent fragments are removed. Adherent fragments are left severely alone save in the following condition. It is essential that there be a free access to the bone marrow for the rubber instillation tube, for thus only can one be certain that the solution will bathe all the fractured surfaces. In certain of the contact fractures adherent fragments may prevent access and it is necessary to remove them, taking pains, however, to strip off the periosteum and leave it adherent. It is self-evident that the cup-shaped, water-tight wound is easiest to sterilize. Hence dependent counter-incisions are avoided, unless absolutely necessary to remove a foreign body or examine the lower portion of a perforating wound. If made, they are occluded as far as possible with gauze and encouraged to heal promptly. The instillation tubes are directed to the bottom of the wound and into all diverticula to insure that all surfaces will be reached by the fresh solution.

The arrangement of the tubes differs according to the type of wound.

If it will retain fluid and has no diverticula, a single tube is inserted to the bottom, through which the solution is supplied by the constant-drip method. If the wound is complicated, requiring several tubes, the solution is supplied by two-hourly flushes, with just enough fluid to replace the old. In the case of dependent wounds, the tubes are covered with towelling in order to carry the solution by capillary attraction to all surfaces. These latter tubes are much more difficult to manipulate, in that they become quickly soaked with pus and must be frequently changed.

Care must be taken to secure the larger bleeders, as sodium hypochlorite dissolves blood-clot and thus prolongs hemorrhage. Vessels are tied with cat-gut rather than with silk, as the latter is quickly dissolved by the solution. After the bacterial count has been below one per five fields for about a week, the wound is closed by suture, adhesive straps or pressure pads. If there is a cavity in the bone I prefer to fill it with Morison's paste.

As regards fractures in the suppurating stage, certain of them present but small sinuses and inconsiderable fracture foci, such as the deeper grooves and incomplete penetrating and perforating fractures. For these I have found Morison's paste very useful. After a thorough cleansing of the wound, the paste is applied and the skin edges approximated if possible. There is generally a yellowish discharge for a few days, and then the skin wound heals. For the more severe fractures, with large wounds, I prefer Carrel's method carried out as described above. It permits of an early plastic closure of the flesh wounds, whereas Morison's paste, in my experience, does not.

As regards fresh, pre-inflammatory fractures, I have had no experience with either sodium hypochlorite or paste. Judging from their effect in later wounds, I should say that, in fresh wounds with limited fractures and minor injuries to the soft parts, the paste would be preferable. It would undoubtedly sterilize such a wound. I have evacuated an abscess which had developed about a shell fragment, introduced the paste and sutured the incision tightly without ill effects and with a speedy healing. Moreover, under transport conditions, it would be of inestimable value, in that so little dressing is required. In the more severe wounds, with extensive fractures and soft-part injuries, I should prefer Carrel's treatment. I should hesitate to close such a wound with paste, for there would be many small clefts, overlooked at the time of exploration, which would lodge pathogenic organisms. Not being reached by the paste they might cause an adjacent infection, either phlegmonous or gaseous, which would be treated at a disadvantage if the wound were blocked and free drainage impeded. However, I

admit that this is a debatable question to be proved only by actual tests. So far as I know, not enough of them have yet been made to settle it. I prefer Carrel's treatment in the inflammatory wounds for similar reasons, in that it does not obstruct a wound whose potency is necessary for adequate drainage. In the suppurating wounds I prefer sodium hypochlorite if it is evident that the soft parts can be approximated only under severe tension or by plastic methods, for under such conditions one may confidently expect healing by first intention.

It must be admitted that the last word in antiseptic solutions has not yet been uttered. The care required in the technique and preparation of Dakin's solution has prevented its instant and universal acceptance. Many surgeons have apparently had indifferent results with it, probably through carelessness. Constant experimentation is going on to find an antiseptic more easily prepared and applied. At present the flavine compounds are under investigation and have already acquired a number of adherents. It is, at all events, significant that most of the inquiry lies along the lines of antisepsis.

The following are the notes of a case that represents the average of the results which I have had:

Rfn. I .R. C., $^1/_{12}$ Lond. Regt. Non-perforating shell wound left arm, at Arras, April 9. Compound fracture of the humerus middle third; infected. Museulo-spiral paralysis. Admitted to A. W. W. H., April 29. May 7—Abscess evacuated. Wound carefully cleaned and necrotic bone removed. Osgood-Penhallow splint with dorsiflexion of wrist. Two tubes inserted for instillation of sodium hypochlorite. Bacterial count, infinity. June 10—Firm union. Bacterial count, one per field. July 3—Bacterial count, one per twenty fields for last week. Bone cavity filled with *Bipp* and wound sutured. July 20—Wound healed, firm union. Massage and electricity to forearm and arm muscles. Movements of elbow limited by biceps adhesion. July 30—Patient fell, partially refracturing humerus. Wound opened, blood-clot evacuated. Carrel's treatment begun and continued until August 10. The wound healed promptly: Patient transferred September 8. Musculo-spiral paralysis improving.

Before leaving the subject of infection, it will be well to consider the treatment of those of gaseous and tetanic origin.

As regards gas infections, those of localized type are most easily treated. If the infection is localized to the wound, the procedure would be through cleansing of the wound, incision of the cellulitic area through the skin to the deep fascia, and instillation of Dakin's solution. With gas abscesses, incision and cleansing of the abscess cavity, with subsequent instillation, will suffice. In the case of localized muscle infections, the wonnd must be cleaned and generous incisions carried deeply through skin and fascia into the affected muscle, with immediate instillation of sodium hypochlorite.

Of the more severe types, cellulitis is treated by incisions through the skin to, but not through, the deep fascia, and extending somewhat beyond the area of infection. If the process continues to spread and dangerous general symptoms supervene, an immediate amputation must be done. If only the distal segments of the extremities are involved, it may be done through the middle or upper third of the proximal segments. If the latter are involved, it must be done as close as possible to the trunk. The flush amputation is advisable, as it proffers the best possible drainage. In the case of gangrene of larger groups of muscles the treatment will depend upon the urgency of the general symptoms. If not urgent, the wound must be cleaned, incisions carried deeply into the infected muscles, the larger vascular sheaths incised and exposed proximally, and all wounds irrigated. If urgent, immediate amputation must be done along the lines just indicated, with exposure and treatment of the vascular sheaths of the stump. In the case of massive gangrene, of course, immediate flush amputation is necessary, with treatment of the vascular sheaths.

The treatment of tetanus divides itself into the prophylactic and curative. On account of the large number of cases developing in the early months of the war, universal prophylaxis became necessary. The method of attaining it has been gradually modelled and re-modelled until at present the following routine is recommended in the British service. All wounded receive 500 units U. S. A. of antitetanic serum subcutaneously as soon as possible. These injections are repeated weekly until the wound is healthy, at least three injections being given, unless the wound heals before three weeks have elapsed. In the cases of prolonged convalescence, such as compound fractures, four successive injections are considered sufficient. In view of the danger of latent tetanus, a prophylactic dose is given preferably forty-eight hours before attempting subsequent operations. From August, 1915, to July, 1916, fifteen cases of latent tetanus were reported in home hospitals with a mortality of 40 per cent. As already mentioned, there has been one case in this hospital.

The effects of prophylactic treatment have been very marked in the British army. It has been estimated that tetanus develops in 0.65 per cent of the wounded not receiving serum and in 0.26 per cent of those receiving it. The mortality has been reduced from 78.2 per cent to 31.0 per cent. Of thirty-four cases, reported among the first 179 cases from over-seas, not receiving serum, the mortality was 94.1 per cent. With the diminishing mortality there is a proportionate increase in the periods of incubation.

In the treatment of developed tetanus, stress must be laid upon

the intensive administration of serum and careful cleansing of the wound. Carbolic and magnesium sulphate injections have not proved beneficial. Antitetanic serum is given in doses of 10,000 to 20,000 units by three routes—intrathecal, intravenous and subcutaneous. These doses are repeated every twenty-four to forty-eight hours, as indicated. General supportive and sedative treatment must be carried on. The sudden injection of such large amounts of serum may give rise to anaphylaxis, with the development of symptoms referable to the vagus and sympathetic nerves: such as diarrhea, bronchial asthma, low blood-pressure, sweating and pallor. Among 470 cases in home hospitals, there have been reported three cases of anaphylaxis, with one death. There is less danger of it in the subcutaneous and intrathecal injections than in the intravenous, as in the former the foreign proteins reach the circulation much more slowly. Every wounded man has presumably had a small dose of antitetanic serum and, therefore, may be considered in a sensitized condition. If there is doubt, the presence of sensitization may be determined by the allergic reaction; if 0.4 cc. of serum is injected sub-epidermally, a sensitized individual will develop within thirty minutes a raised urticarial or hyperemic area, 1.5 cc. in diameter. If no reaction is obtained, the individual may be considered not hypersensitive. It is best when possible to desensitize the patient. This may be done either by giving a small intravenous dose two hours before the large dose, or in the following manner: dilute 5 cc. of serum with 50 cc. normal saline: give 1 cc. intravenously; four minutes later, 3 cc.; two minutes later, 10 cc.; two minutes later, 25 cc.; in fifteen minutes the full dose may be given. Anaphylaxis should be treated by general supportive measures, by the use of adrenalin, atropin and stramonium inhalations.

(*To be continued*)

AN ANALYSIS OF THE PROBLEM OF INFECTION

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Introduction.—An attempt is made here to analyze into their principal factors certain problems which have arisen in consequence of the infections of war wounds.

During the last three and a half years the main factors which made it necessary to consider wounds anew after experience in civil life have become fairly clear. The inertia of methods of study which were started before a complete analysis of the problems was possible, the necessity for treating cases in great numbers with rapidly developed facilities, and many other conditions, have unfortunately prevented the change in the mode of attack on the problem of wound infections which has become necessary as our knowledge has progressed.

The portion of the American Medical Corps serving with the British has had unusual opportunity for gaining a knowledge of the present method of study and treatment of wounds. A large part of its time has been spent in getting up to date and in treating cases. Thus it also has been carried on by the force of circumstances in the channels laid down, for the most part, before the problems were adequately analyzed.

Now, however, that this preliminary experience has been gained, it is time for a critical study of the situation. The problem as a whole must be analyzed in the light of old and recent knowledge. The end in view must always be the laying of plans for future attacks, the establishment of the necessary organizations for carrying out the plans, and the discarding of probably valueless modes of attack as a scientific and economic waste of time and material.

That analysis of experience and conditions is a prerequisite to intelligent planning is an almost universal rule. To plunge ahead on narrow paths without realization of the problem as a whole means waste of effort and unintelligent force. Yet precipitate involvement in useless work is a peculiar danger of war medicine. Time is limited, and it seems as if something must be done quickly. The American Medical Corps has already shown signs of becoming a victim to the seeming pressure of events. Effort has already been

wasted on useless lines of research. There is danger of being led astray by enthusiastic but one-sided discoverers.

In the numerous papers containing accounts of original experiment or observation, the analysis in each case of the data obtained, and the judgments upon the results of such analysis, are as important as the making of the experiments or observations. But it is merely a logical step to consider the totality of the work already done as one vast experiment having for its object a fully developed and sound treatment for wound infections. Then the individual contributions rank as the data, and the observation and analysis of the whole becomes itself an original work wh complex and important. The primary observers, as the res t of their consideration, may devise new experiments which will clear up certain points; in the same way an observation of the whole attack upon the problem may point out new avenues of approach and solution.

That this is the critical moment for the concentration of thought on the plans of attack on wound infections is apparent because (1) the main facts are no longer obscure; (2) previous experience has shown the limitations of previous modes of attack; (3) the advent of a new body of medical men makes especially *apropos* a new attempt to solve the problems.

This paper is one attempt at an analysis. There ought to be many others, and better ones.

The main problem is to formulate the factors of a sound method of evolving better modes of treatment of war wound infections. If the necessary main factors are clearly formulated, it should be easy to discover the cause of the lack of progress in the past and of the failure to agree at present upon the relative values of different modes of treatment. It should also be possible to devise the most practical mode of attacking the problem under present conditions.

The Factors in the Problem of Making Sound Progress in the Evolution of the Treatment of War Wound Infections.—The problem is two-fold: (1) That of creating a mode of treatment likely, from all we already know, to be successful. (2) That of deciding which of any two given modes of treatment is the preferable for a given case.

The first sub-problem is necessarily partly dependent upon the chance original ideas of scattered individuals. There are, of course, certain well-recognized modes of attack such as: (*a*) Analysis of existing modes of treatment, to see what elements of good, if any, there may be in them. The non-essential remainder can then be

eliminated and the essential factors developed, perhaps by using entirely novel methods. But to decide what is good in a method of treatment necessitates an accurate method of comparison of treatments. This is the second problem, which must therefore first be solved.

(*b*) Another method of solving the first sub-problem is to develop new means of combating the single elements in the infection which are already known; for instance, to develop a vaccine or a serum for some organism already known to be an important factor, or to create a specific bactericidal substance.

(*c*) A third mode is to make a still more complete analysis of occurrences in infection than has already been done; to go into everything that occurs in the minutest detail, in order to be able to devise helps or checks for different phases of the process.

The second sub-problem, that of deciding which of two modes of treatment is preferable for a given case, is the most central problem of all. To compare treatments with accuracy it appears necessary to (1) define the given case; that is, get a definite classification of wounds; (2) eliminate variable factors other than the one to be tested; (3) test treatments on essentially similar cases.

Analyzing these factors further: (1) Classification of wounds —Problem of essentially similar cases. To talk at this period of the war of the best treatment for "a wound" seems the height of absurdity, in view of the known variability of natural occurrences and the scarcity of facts tending to prove that all wounds, or even all wounds with some striking similarities, react alike to each treatment. The sound method would seem to be to investigate wounds thoroughly from every point of view, and then, after a complete classification, to test each variety by each method of treatment. If it is found that each of certain varieties react alike to each treatment, they can be put together in a class, which is thus made on the basis of treatment. In this process there might result a great practical simplification of the undoubtedly complex original classification.

An attempt might be made to test wounds against treatment on the basis of a superficial classification, using obvious and striking features for the basis. The difficulty would be in measuring the amounts of change with the progress of the cases, for these wounds would be only superficially similar, and it would be almost impossible to compare amounts of change when many of the signs and symptoms of the condition would be qualitatively different. If a new treatment were introduced the whole classification would have to be re-

tested. Moreover, if we are to analyze treatments to their elements, it is necessary to have essentially similar conditions upon which to test the elements and the combination of elements. The number of variable factors is great enough without introducing the hopeless confusion of variation in the test object.

The main sources of variation in the types of wounds, aside from variations in the subject (to be dealt with later) appear to be: (*a*) obvious anatomic alterations—tissues destroyed; (*b*) pathological changes in tissues present; (*c*) foreign bodies in relation to tissues; (*d*) character and numbers of bacteria and their relationships to tissues and foreign bodies; (*e*) previous treatment.

(*b*) Of pathological changes in the tissues all but the scantiest observations are lacking. The absolutely essential need of knowing the microscopic changes from near the onset will be apparent below.

(*d*) Up to the present time some studies have been made of the character of the bacteria present in the wound wall, but scarcely any of their relationships to the tissues and tissue products. Practically the only studies concern the relationships to the leukocytes on the wound surfaces. Their relation to the tissues of the wound wall and to the processes of regeneration and repair are important factors still neglected.

(*e*) The previous treatment is not hidden by other modes than insufficient records. Comment on this phase is not necessary.

The importance of knowing these things before any marked change has taken place since the infliction of the wound, is necessary, for one thing, to eliminate variations in the state of immunity due to variations in the numbers of bacteria and the character of their relations to tissues. For instance, we might have two wounds, each two weeks old, in apparently the same condition pathologically and bacteriologically. In one there might have been a heavy inoculation of the wound wall which progressed a little, then was being overcome. The second might have had a negligible original inoculation of the wound wall, but an invasion a week later from the exudate on the surface. This infection might be on the upward curve. Obviously the whole condition, especially the immunilogical relations, are basically different, although the picture at the time is the same The two wounds, even though on the same patient, would offer no fair basis for the comparison of methods of treatment. This is merely an example of the necessity for early investigation of the wound.

To make concrete the method of arriving at a classification, it

seems necessary: (1) to make sections of tissue from the wound wall; (2) cultures of the wound wall and surface; (3) definite anatomical observations and studies of foreign bodies; (4) to do these from the earliest moment at which any perceptible change takes place from the onset of the wound. This should be done on a series of wounds, each under the same treatment, until the subject is covered.

It is now evident that this main factor of thorough classification has not been developed to anywhere near an adequate extent. (Difficulties in technique may account for some deficiencies.) It is also evident that to classify properly requires medical control of cases by a body of investigators from near the onset of the wound to the completion of the study. Probably this could be best effected by a base hospital with a staff of investigators who have full power over the cases sent them from the time they reach the first-aid stations. Assistants at points on the way could make examinations and records.

2. The elimination of variable factors other than the differences in wounds. Apparently very difficult, this might be done to a practical degree by proper organizations and methods. (*a*) The variations in age of the patients present no great difficulties. (*b*) Variations in wounds have already been considered. (*c*) Variations in natural resistance of the subject are not so great as in many other cases. We are not dealing with men falling sick of a disease in a civil community where all are more or less exposed and, consequently, where the sickly are apt to have a low and variable resistance. We are dealing with men forcibly inoculated, and, moreover, with more or less picked men. The condition is analogous to a laboratory inoculation on a series of animals. What variations are present can be averaged by using a sufficient number of cases. There is, by the way, a field of possibilities in finding simple methods of measuring the resistance.

3. The variable treatment can be made a constant by organization giving control over the treatment. Let it be noted that no mention is made of establishing a normal course of evolution for a wound. To prevent the patient touching the wound is a treatment. Hence all wounds are treated in some way, and we merely compare different methods.

It seems very difficult to see how the comparative value of treatments could be judged accurately without including the factors outlined above. If a treatment is extraordinarily bad or extraordinarily good, it might be obvious without such control. But to make real

progress in developing methods of treatment—for instance, to analyze the methods now in use to find the elements of good, or to judge only moderate differences in result—such controls are necessary.

Although treatments cannot be compared accurately without large organization, it is entirely possible to reach certain rough conclusions with regard to treatments with existing facilities in the following ways:

(*a*) On the observation of important specifically harmful effects a treatment can at once be condemned. For instance, if a treatment causes solution of tissue with resulting hemorrhage and does this in every case, it obviously can be discarded. Or, to take other cases, if a treatment causes such pain that an anesthetic is practically necessary for each dressing, it at once can be condemned. Less obvious harmful effects may be observed by study of the microscopic pathology of the wound.

This method of judgment, then, consists in the observation of marked definite harmful effects on the patients' tissues, such as could not result from the usual infections or injuries, observed in practically every case, and important enough to render the treatment impracticable.

(*b*) The converse—that is, the acceptance of a whole method of treatment because of some obvious good point—is not practicable. If there are other, bad, points they may more than counteract the good. For instance, if a treatment cleans up sloughs beautifully but encourages bacterial growth of an undesirable sort, its advantages are not enough to make it acceptable.

(*c*) There is theoretically another method of judgment by specific effects. Thus, if all the essentials of normal wound healing are known and it is found that a treatment has no deleterious influence on any one, but favors some one or more essentials, it can be judged a good method. The danger in this is that some obscure but essential factor in healing may be influenced unfavorably without our knowledge.

(*d*) On observation of a large number of wounds treated in a given way, which heal well without complications, the treatment may be judged, roughly, not undesirable for the "average" wound, and gross differences in the average effects of treatment may be observed. The clinical observation of the process of healing is a rough gross pathology of the wound, and a much more sound basis of judgment than any one method of laboratory observation in common use at the present, such, for instance, as making observations

on the bacteriology of the exudate. The combination of acute clinical observation with a few definite laboratory tests, as:

(*a*) Determining the nature of the infection.

(*b*) The change in bacteriology from day to day, resulting from the treatment and the patient's resistance, appears to be the best basis of judging treatment at the present time.

(*c*) If methods of observing the microscopic pathology of the wound prove practicable, an important addition is made to the basis of judgment.

Such laboratory procedures as the use of ingenious methods for observing the bacteriological power of leukocytes, when removed from the wound and put on agar plates or glass slides, are useful as a method of analysis of leukocyte activities. But for many purposes the activities of the cells can much better be observed under the more natural conditions of the wound itself. The condition of cells in the wound is a much better approximation to the conditions after closure, for instance, than are the characters of the cell activity on agar or glass.

After all, none but the gross differences can be observed in the way outlined above, until wounds are definitely classified. Even then we need complete observation of the wound from the start. Large numbers of cases are necessary under present conditions to make even a rough judgment possible. If we confine ourselves to such methods, little progress can be expected in the evolution of better methods of treatment.

As to the possibility of making use of animal experimentation in comparing treatments, it seems evident that it has distinct limitations except in testing specific destructive measures. When the question is of specific chemotherapy or of an immune serum, the criterion is the fairly rapid destruction of the bacteria without much consideration of the inter relationships of the bacteria with the tissues, or of the process of repair while bacteria develop. But when non-specific antiseptics are to be judged, the bacteria are in the same relationship to the antiseptic as in the human case, but are in a different relation with the tissues. Their relation to the tissues is an essential part of the problem, hence animal experimentation offers no valid comparison.

All sorts of questions, especially physiological ones, could be decided by animal experimentation—such matters as the influence of substances on the transudation of serum, or the migration of leukocytes—but many of these might well be studied on human cases.

For the main development of treatment and for the final judgment we must inevitably rely upon controlled series of human cases.

No hospital alone, in the very nature of the case, can completely classify wounds or even, given a classification, compare accurately methods of treatment. The place of the single hospital in studying wounds is to apply itself to parts of the classification problem within its power, and to the other problems in connection with wounds. This will not mean a loss of stimulus. The most interesting problems, and those most needing originality, can still be attacked. The big main problem is a necessary, but less attractive, task. It is more machine-like—a sort of super routine.

The Evolution of Treatments to be Judged.—(1) Analysis of present methods to find the elements of good (if any). Assuming that we have the necessary organization and knowledge to compare treatments, if we find that the benefit of the Carrel treatment lies in its successive physiological treatments, and not at all in the antiseptic action of chlorine, it may be possible to develop the physiologic actions without the chlorine. For instance, the whole question may be seen to depend on a method of cleansing the wound surface with a solution of a certain degree of irritating properties. The physochemical relations of fluids to tissue debris could be tried out to find what best facilitates harmless cleaning of the wound surface. It might be found that, with fluids harmless to the tissues, a large factor in the decision as to wound dressing would be the purely mechanical and physicochemical properties of the substances applied. The antiseptic power of chemicals, leukocytes and body fluids might drop to an extremely subordinate position, as far as the wound surface is concerned.

It might be found that chlorine itself had a beneficial action, entirely apart from its antiseptic properties, and other elements might be found to possess a similar property in even higher degree.

The above mode of attack is capable of development in very great detail, but the system of controls must first be developed before the final tests can be made.

The method of seeking to combat single phases of the problem, as by antitoxins or vaccines or specific bactericidal compounds, is one capable of more immediate attack. The search for specific chemotherapy does not seem likely to have possibilities of rapid enough development for the present purposes. Antiseptics may possibly be of use if it is found that the harmful tissue destruction is more than counterbalanced by the killing of bacteria and the washing away

of the killed tissue, which should be a part of an antiseptic method. The non-specific nature of antiseptics in general, and the growing weight of evidence that the tissue destruction wrought is more harmful than the bactericidal effect, make it probable that the development and testing of antiseptics as such is an unprofitable line of research. It seems more probable that future treatment will depend on the development of mechanical, physicochemical and physiological methods.

The attack by the study of bacterial interrelationships—symbiosis and antagonism—is complex and of unknown possibilities. This may be called the biological mode of attack.

The third method above, that of a still more complete analysis of the natural processes in infection, need not be explained in details. However, the following example is given: (*a*) to show the complexity of the subject; (*b*) the many possible avenues of approach; (*c*) the inadequacy of work up to the present time.

The relation of the changes in the pus on the surface of the wound wall to the condition in the wound wall apparently is governed by the following factors, among others: (1) Relation of each kind of bacteria to the leukocytes in the pus. (2) Relation of each kind of bacteria to the leukocytes in the wound wall. This would be different from (1), since the leukocytes in the pus are outside of their normal tissue environment. (3) Relations in (1) and (2), but taking into consideration relative numbers. (4) Relations of bacteria to tissue fluids in pus. (5) Relations of bacteria to tissue fluids in wound wall (6) Nos (4) and (5), taking into consideration numbers and amounts. (7) Relations of bacterial products as in (1) to (4). (8) Relations of tissue products as in (1) to (4). (9) Relations of bacteria to tissues in wound wall, including regeneration, repair, etc. (10) *a*. Relations of treatment to bacteria in pus; *b*. Relations of treatment to bacteria in wound wall; *c*. Relations of treatment to leukocytes, tissue fluids and tissues. (11) Interactions of the above factors.

Here appears a complex series of relationships, not to be solved by the study of the surface exudate, and all concerned in the factor of bacterial presence in and on the wound tissue.

In brief, the wound consists in: (1) The absence of tissue normally present. (2) Pathological changes and regenerative changes in tissues present. (3) Retained foreign bodies. (4) Bacterial presence within the tissues. (5) Tissue products, cells and bacteria on surface of remaining tissue. (6) Distant changes in the animal wounded.

It follows from this analysis that to investigate the exudate on the surface of the remaining tissues and to note the lack of tissue and gross appearance is not to observe the wound thoroughly. It is not denied that in this superficial film of cells out of their normal environment may be found an index of the condition of the whole wound, but until the whole wound is investigated we cannot establish the relation. Certainly, until the subject is clearer than at present, the modes of attack should not be restricted. The efforts already made chiefly suffer from lack of control in observation, and this seems to be an almost universal defect, even with the most ingenious experimenters.

Thus only half the problem has as yet been attacked. The effect of agents in the processes in the wound wall still lies in obscurity. Let us suppose there is a body of troops which has just advanced into the enemy's trenches, and a general concentrates his observation on the struggles of that advance guard, forgetting the condition of the reserves behind and of the lines of communication, which are meanwhile being shelled and raided by air and land and becoming disorganized. The general cannot tell why his troops fail, or possibly succeed, and he may be an important general. The pus on the surface is the advanced troops out of their former protections, and the wound wall is the lines of communication and front trenches. The whole wound must be studied, and the whole animal.

Numerous sub-problems may be indicated by two examples:

1. The devising of indices to show the fitness of the wound for closure. This is a problem which might be solved on an empirical basis by trial and statistics, but probably much better after a complete study of wounds.

2. The artificial restoration of lost tissues like skin and blood.

Conclusions.—The problem of how to make better progress in the future seems to depend, first of all, upon a thorough analysis of the nature of the problem. This paper does not pretend to be such an analysis, but merely to indicate a method of attack. After analysis the main factors of success should be included in a mode of attack practical under war conditions. Expense and number of men necessary to solve the problem should be a subordinate consideration, as the probability of saving is enormous.

Probably unprofitable lines of investigation, of which the following may be examples, should be relegated to a subordinate position.

1. Attempts to compare treatments with accuracy without the necessary organization and preliminary knowledge of wounds.

2. The evolution of antiseptics for their antiseptic properties.

3. Specific chemotherapy.

4. Attempts at direct chemical effects.

5. Poorly controlled experiments of any kind.

6. Attempts to solve problems that cannot be solved decisively by the force undertaking their solution.

7. Study of tissues under artificial conditions in preference to their study under natural conditions, when the question is of the functional activity of a tissue, such as leukocytes, and the aim is an immediate practical result.

The modes of attack which seem especially promising are:

1. Establishing of a large central research organization in a hospital to study thoroughly wounds from the onset, classify wounds, and compare treatments.

2. Analysis of treatments into their elements. Testing of the elements to see which are beneficial, which harmful, and which indifferent. Analysis of favorable factors, to see whether effect is mechanical, chemical, or otherwise brought about. Development of beneficial factors, elimination of the remainder.

3. Search for harmless agents with definite mechanical, physicochemical and physiological properties, for the removal of exudate, protection of the wound surface, and stimulation of protective reactions.

4. Search for better mechanical methods in the line of surgery.

5. Search for biological weapons of attack.

6. Further analysis of—(*a*) pathological elements in wound infection; (*b*) bacterial elements in wound infection; (*c*) physiological elements in wound infection; development of facts found in (2) and (3).

7. Following of more isolated lines of attack.

8. A further extension of organization is desirable to facilitate intercommunication between the supposed central research body and the various hospitals where phases of the problem are being worked out. This can only be done effectively, as we think, by personal consultations. The method of periodical meetings or publications for many reasons is comparatively ineffective. The central research body should itself, or by delegates, consult with laboratories of hospitals doing research with the following objects: (*a*) Avoidance of duplication of work. Meetings cannot bring this about, as work is not presented until it is done or nearly done. (*b*) Giving and receiving ideas and knowledge. This can be done much better in the separate laboratories than in any more or less formal gathering.

The research body becomes a clearing house for knowledge and work in progress. (*c*) The stimulation of work. New lines to work out can be indicated because of the broad view of the situation by the central committee. (*d*) The recruiting of new men by the central organization.

In case the central hospital organization is not established, the next best substitute is a research body primarily founded as a clearing house of ideas and knowledge rather than as a body of workers, as outlined under (8). This would be a very inferior substitute and would result in a nearly total failure of solution of the most important factors in the problem. The comparison of treatments would be limited to the basis of—(*a*) specifically harmful effects; (*b*) rough clinical judgment and simple laboratory procedures on unclassified cases, the limitations of which are discussed above.

The base hospital, or other single hospital in these plans, does not fall into an undesirable minor position. The research, which is to be carried out by the central research hospital, would be machine-like and of the nature of a super-routine. Other hospitals would have the function of more purely original work, striking where the ore is suspected. They would receive help, but would not be under the dictation of a constant pressure of methodical investigation.

Fortunate ideas may lead to highly successful modes of treatment without much preliminary work. The impossibility of being sure of advantages of such methods, and the great improbability that they would apply equally well to more than a fraction of the cases, make it unwise to rely on them. Granted the subject is important, the urgency is apparent, of attacking it in the ways reasonably certain of leading to progress.

NOTES ON SHELL SHOCK

By Major E. K. JOHNSTONE

Formerly Surgeon, U. S. V.

SHELL shock is a comparatively recently recognized disease produced by the effects of the new tremendous high explosives combined with trench warfare. It is the result of concussion and commotion in relation to the central nervous system.

Cases of shell shock to the surgeon who has any neurological or psychological training seem to fall under three heads:

1. Neurasthenia and hysteria (or pithiatism, as Babinski prefers it to be called), usually to be found in a somewhat neurotic soldier, quite unable to bear the strain of modern warfare, especially modern trench warfare, at any rate for more than a short time. These cases are harder to care for successfully than the cases where a strong normal type of man suffers from real shell shock.

2. Malingerers. Soldiers who from lack of pluck or any other reason desire to return home temporarily, or perhaps hope to be permanently invalided out of the service. These men have seen the real article; they have seen how little evidence of injury exists, and they have seen a man whom they knew to be undoubtedly a sufferer, accused of malingering and perhaps treated with contempt. They are clever enough to argue that if the real thing is so difficult to be sure of, it must follow that it will be also difficult to detect the spurious imitation.

3. Soldiers suffering from genuine *shell shock*, the signs and symptoms of which vary considerably. There is loss of function and disordered function due to interference with the central nervous system all caused by exposure to the effects of high explosives, and usually following concussion with loss of consciousness or inhalation of poisonous gas. Often being buried by the exploding shell also plays no small part in bringing on this condition. The immediate cause is also often attributed to the soldier being struck on the head or spine by sandbags hurtling through the air, the roof or walls of the dugout being blown in, and the man being blown up or blown against something resistant. "Gassing," as before mentioned, plays a not unimportant rôle in some of these cases—poisonous gas from a gas shell—or, where the soldier is lying helpless, a drift of the poison gas liberated by the enemy; or possibly the gas from an exploded mine.

Aerial concussion due to high explosives can, without visibly injuring the soldier, actually cause his death. This has been ascribed to "sudden arrest of the nervous mechanism." This commotion, if it does not actually cause death, is the cause of disordered function or loss of function—consciousness, memory, speech, sensory perception—in fact any of the special senses may suffer.

When a normal, perfectly sound individual, both mentally and physically, can be a victim of shell shock, it is far less likely that a neurotic type of man will escape, if one considers what must be endured by a modern soldier in this modern warfare.

Trench life, where the soldier is in a condition of continuous high tension, with a dugout the only shelter, is trying at the best of times, but when in addition the soldier is annoyed by vermin such as rats, plagued with parasites such as the acarus scabei, and lice, wet through with no facilities for drying out, cold, often on short rations on account of the approaches being shelled, sleepless or with sleep broken as an additional torture. Then there is the incessant pounding of the big guns, and, worse than all, comrades periodically killed before his eyes and witnessing the tortures that must be endured by those that are fortunate enough to be only wounded; then last, but not least, continually facing, if not actually in dread of, death or mutilation himself.

It may sound a contradiction in terms to say "fortunate enough to be wounded," but anyone who has had to deal with the maimed victims of this modern holocaust—the Great War—knows that the amazing cheerfulness that characterizes these splendid fellows is due in no small degree to each one being convinced of his own good fortune in having reached home at the price of his more or less painful wound. The loss even of a limb is borne philosophically, one might almost say jubilantly, as the maimed one is certain that this at any rate will get him his "ticket" (soldier slang) for being "invalided out as permanently unfit." It is a fact that the only wounded soldiers who ever speak as if they would like "another shot at it" are the limbless ones.

It may be as well to give a picture or two of "shell shock."

Case 1.—A young clerk, 20 years old, of good middle class family, a skilled pianist, after nearly one year's training in England—with only a little under two months in France, of which but a few days were passed actually in the trenches, being neither wounded nor "buried" was marked B (Blighty), that is, he was sent home from the base hospital. His diagnosis was "shell shock." After months in hospital in England he is unable to walk; he goes about in a wheel chair. His

tremors are very distressing even to a casual observer, and whenever he makes the least effort they are markedly increased, except when his chair is wheeled up to a piano. Then he plays, if not as well as ever, at least most acceptably as far as his comrades are concerned, and his tremors are unnoticeable.

Case 2.—Another man, a Yorkshire miner, of good, sturdy stock, accustomed to hard work—with all the stolidity and stubbornness often attributed to Yorkshiremen.

He gave a history of being buried by a huge high explosive shell when on his way back from a raid with seven comrades. He remembered the explosion and, when he came to himself almost buried in a shell hole, lying across him was a very heavy comrade, dead. Four hours later he was dug out and was found to be the only survivor of the eight.

When he was dug out he was paralyzed. He had suffered from spinal concussion; it caused paralysis of both arms and both legs and rectal and vesical incontinence.

Though this is due to a degeneration of the pyramidal tracts following on an intrathecal hemorrhage caused by the spinal concussion, he is gradually becoming less helpless and is one of the really cheerful men in the ward. He will undoubtedly make a much more satisfactory recovery than the soldier previously referred to.

Case 3.—The other case was that of a major likewise afflicted for months. He was brought to tea by his medical attendant and when left alone with the doctor the latter said to him casually: "Are you here for treatment or to pay me a visit?" He replied, using a pencil and pad, "For treatment—not that you can do me any good; I'm really rather sorry I've come, but so and so," (mentioning the eminent specialist) "insisted. Electricity is your long suit and I have had tons of it. It always makes me worse." The doctor said: "Well, let's see your throat and vocal cords anyway." The major squirmed away from the depressor, and was handed his hat and stick with the remark, "You have decided to place yourself in opposition to me even in a small thing of this sort—good-bye." Two days later the major crawled back again begging to be given his chance. When the examination was concluded the doctor noticed a rather remarkable condition of anesthesia over the left chest. (Anything may be found in shell shock cases.)

The major wrote, "Ah, that surprises you." "Not at all," replied the doctor; "just what I was looking for. Your center of speech is in the right half of your brain, that being affected; the left side of your breast of course is also. I shall proceed to treat that condition. As soon as you can feel the current on your chest your brain will also be cured, and you will speak." Of course this was mere buncombe. The clever doctor wanted to take his patient's mind completely off his speech disability and get him to think of his chest. After a sitting or two, merely passing an electrode over the chest, he turned on a

strong current, and so surprised the major that he exclaimed, "I feel it." He was cured, at least as far as speech was concerned.

One could, unfortunately, proceed almost *ad libitum* to select cases, each one having some point of interest. We will, however, only glance at a couple more, each occurring in the practice of the R. M. O. of one of the most celebrated of the London nerve hospitals. This neurologist is so successful that he has the more difficult army cases sent to him by men like Major Mott, and many of the great London consultants make use of his skill in this direction. We will only glance at these cases, as they will probably shortly be seen in print in the book on "War Neurosis" he is at present engaged on.

Case 4.—A very stubborn case of loss of speech that had resisted all treatment for two years was sent to be treated. The patient was a veteran of the retreat from Mons—one of the old "Contemptibles." When he appeared he was taken to a room where was a most formidable array of electric apparatus. The session lasted four hours, from 8 o'clock until midnight. It was a most stubborn case. Fortunately the patient had been emphatically made to realize his last hope of recovery ended with this doctor, and the doctor was on his mettle. He was given electricity by various impressive methods, and the different colored lights were flashing; then he was walked up and down until he was tired out, and the electric business began again. He was so fatigued that he was dropping asleep, and his feelings were so harrowed by the neurologist's "tactful remarks" that he was actually weeping. When he cried enough the doctor, who had the key of the room in his pocket, said, "If it kills you, or if it kills me, you are not going to leave this room until you can speak." Then the business began all over again. The neurologist appealed to everything that was best in the man, reminded him in detail of all he had gone through, told him that although he had proved himself a hero, this was the fight of his life, etc., etc. Until he could speak he had not a chance of leaving the room, not if it killed them both. The doctor had his reputation to consider.

Finally weeping, and half off his head, the man managed to bring out "Ba; Ca; Da"—the simple vocal exercise prescribed in such cases —and he was put to bed upstairs, cured.

Loss of consciousness at the time of injury characterizes most of the severer type of shell shock cases, or, if not this, the memory of what occurred seems to have been wiped out. Many of the ordinarily wounded—some indeed with very slight wounds or none at all—are in a dazed, sleepy condition; this however, after a longer or shorter period of rest, depending on the man's strength of mind, seems to pass off. Cases of this type will on inquiry prove almost always to have been "buried." In fact, after he has had some experi-

ence, a surgeon can at a glance almost always pick out the "buried" cases that come into his wards. These slightly "shocked" cases are, of course, not labeled "shell shock" or at any rate "shell shock" is only marked down as a complication. These men all suffer from bad dreams, living their terrifying experiences over again in their sleep, not unlike the civilian's occasional "nightmare." Then the "falling through space" sensation is a very constant complaint. The dreams gradually cease as the patient gets better, and, as he gets better, an indescribable "haunted" look he has in his eyes passes away.

Cases of actual "shell shock," if the soldier be blessed with a sound nervous system, will recover if the patient has complete rest mentally and physically and the ordinary hygienic rules are enforced without any special treatment. "Shell shock" cases at the very commencement are occasionally benefitted, as the pressure is supposed to be increased, by having a small amount of cerebrospinal fluid withdrawn by intrathecal puncture. To accomplish anything, this must be done at one of the advanced medical units. On arrival home from France, quiet, restful surroundings are essential. The continuous warm bath at blood temperature, lasting from a quarter of an hour to an hour and repeated at the discretion of the medical officer, is extremely soothing and gives good results. This is combined with a nourishing and easily digested diet, also intelligent purging. This regime is sufficient for the lighter cases very often. The symptoms of the more serious vary so considerably that one might almost describe the treatment as symptomatic. All the severe cases suffer from some form of paralysis: tremors, cyanosed extremities, often loss of speech or even blindness, severe headache, giddiness, exhaustion, sleeplessness and, when sleep comes, terrifying dreams.

Paralysis, whatever its form, is first given the benefit of regular massage and electricity, and many cases, whether recent or late, are found to be amenable to suggestion. Major Mott, one of the recognized authorities with regard to this only lately recognized malady, lays great stress in cases of functional paralysis, on associated movements of the two limbs, the sound and the paralyzed, the attendant assisting the paralyzed limb while the patient accomplishes the same series of exercises with the good arm or leg, keeping his mind fixed on what is being done. Very soon, unconsciously the paralyzed limb is doing much of the work without the soldier being aware of how little assistance he is receiving. Colonel Deane considers the associated movements secured by gymnastic exercises very valuable—parallel bars, the skipping rope, Indian clubs, etc.

Diverting the mind at the same time as the limbs are being exercised, by performing useful tasks in the workshop in bad weather and in the garden, when the weather is good, has proved to be of great value—of course this is for the convalescent—and care must be taken that the task allotted is not beyond the patient's strength. Later absolute farm work is to be recommended. An open-air existence with all that life in the country entails, is far better for a shell shock sufferer than any other life.

With regard to the deafness, the majority of the cases are functional, others being due to injury of the drum. Less than 20 per cent are due to ear diseases. The condition has been described as "cortical brain deafness."

The blindness is not due to injury, and in the majority of the cases no eye condition is discoverable that might account for it. The sight may be restored as suddenly as it was lost, and not infrequently by suggestion.

The same remarks are applicable to the loss of the power of speech. In certain cases the X-ray has shown that the diaphragm hardly moved while under examination, even when the patient apparently made every effort. In such cases selected breathing exercises are recommended.

From the very beginning we must be most careful to avoid any suggestion of the case being one in which recovery is impossible. The patient is encouraged to leave his bed at first for only a few hours daily, and this time is better spent, as far as possible, in the open air. Diversions of a mild nature, such as fancy work, are supplied, non-exciting entertainments of various sorts are given—usually reading or anything that requires concentration of the mind is beyond him. Care is taken that he should not be left alone, as this encourages introspection and brooding on his terrifying experiences. If the mind is not diverted, these experiences, which of course are the foundation of the alarming dreams at night, obtrude themselves on the consciousness during the day. Later games are provided, but at first these are not suitable. The patient cannot make the effort necessary, just as he is annoyed by a piano or a gramaphone, though later he may enjoy these very things. It is most important to remember that strict discipline must be preserved. These men are soldiers and are accustomed to discipline. Gentle kindliness and discipline are not incompatible. About this time what the patient takes most pleasure in is his meals, and a plentiful palatable diet is very important. It is surprising what a soldier will bear quite cheerfully if only his meals are "trés bon," as he phrases it.

As far as I can ascertain, as yet no "Army Council Instruction" or "War Office Memorandum" has been issued in regard to the medical aspect of shell shock. This is surprising, as a memorandum has been published in regard to nearly every important condition.

However, two "orders" have been issued, the only papers dealing with shell shock that I can find among our records. These, however, if one reads between the lines, are illuminating.[1]

In closing, in order to emphasize the importance of this new malady, and the very great need of its being understood and properly treated from the beginning, it is only necessary to note the following report of a question put to the Government in the British Parliament last July.

Mr. Stewart asked Mr. Barnes whether his attention had been drawn to an appeal for money issued on behalf of recuperation hostels for the sailors and soldiers invalided from His Majesty's services with nerve strain in which it was stated that men had been, and were being, invalided out of the service in large numbers, with no prospect before them but the workhouse or asylum, or a miserable existence as a burden to themselves and their relations. Mr. Barnes replied that the terms of the appeal did not accurately represent the facts with regard to men invalided out of the service on account of nerve strain.

Recognizing the special difficulties presented by neurasthenia and shell shock, a special medical board had been constituted to deal with all such cases and to award pensions or gratuities to them. Cases of neurasthenia and shell shock invalided out of the service before the special board was instituted were entitled to be re-examined by the board at all times, and Local War Pension Committees have been specially instructed to report to the board, with a view to re-examination of any case which in their opinion was not being suitably treated. All cases of men invalided from shell shock were granted either pensions or gratuities, but in either event they were entitled to treatment or training under Article VI. of the Royal Warrant. Provision had been made for their treatment in an institution with 105 beds at Golder's Green, and its accommodation was about to be increased by 50 beds; other suitable accommodation was being sought in the neighborhood of London. On July 21 a hospital for 50 of these cases was opened near Belfast. At Leeds 100 beds were being provided, and at Leicester another 100. Men were also being sent on the recommendation of the special board to recuperative work on farms in Essex. He hoped by these institutions, increased to any extent that might prove necessary, to carry out with state funds the objects of the appeal to private charity referred to in the question. If there were any mental cases or any insane men as a result of shell shock or any other cause, they were

[1]Copies of these orders appended.

suitably provided for. Allowances were made to wives and children on the widow and children scale.

COPY

C. F. & E. C. 3-15267.

BEDFORD DISTRICT

Particular care should be taken that cases of neurasthenia, hysterical paralysis, shell shock and similar cases should not be allowed to remain too long in the auxiliary hospitals. They get too much attention, recovery is delayed, and the patients become hospitalized.

After a short interval they should be brought back to the Central Hospital and disposed of as follows:

(*a*) Obviously incurable cases should be invalided.

(*b*) Application should be made for suitable cases likely to benefit by the treatment to be sent to No. 4, London General Hospital, Denmark Hill.[1]

(c) Slight cases to be sent to the Command Depot. A copy of this letter should be sent to Officer-in-Charge, Central Hospitals.

(Signed).....

Lieut. Colonel for D. D. M. S., Eastern Command.

ARMY COUNCIL INSTRUCTION

No. 587 of 1916.

WAR OFFICE,
16th March, 1916.

587. Disposal of men discharged from hospital after suffering from nervous shock.

Men discharged from the Springfield War Hospital, Upper Tooting, S W.; Napsbury War Hospital, Napsbury; and the Red Cross Military Hospital, Maghull, near Liverpool, as "fit for light duty," on recovery from mental disturbance consequent on the strain and shock incidental to service in the field, will not be included in a draft or unit overseas for at least one year from the date of such discharge. The documents of such men will be marked by the medical officer in charge of the hospital from which they are discharged, "Home Service for one year (N. S.)." Such men will be sent to a command depot and afterwards be posted to a reserve unit employed in a suitable regimental employment for the remainder of the period specified, at the expiration of which they should be brought before a Traveling Medical Board in order to determine their fitness or otherwise for service at the front.

24-Gen. No. 4420 (A. G. 1).

By command of the Army Council,
Signed.....

[1]The hospital of Major Mott, whose original work on these cases has been most valuable, see his Chadwick lecture, and whose name has appeared several times in this paper.

A FEW CIVIL WAR HOSPITALS

By Major CASEY WOOD
Medical Reserve Corps, United States Army

(With five illustrations)

WHEN Colonel Owen, of the Army Medical Museum, very courteously allowed the writer the use of a room in the building of which he is curator, it was found necessary to clear it of material—mostly the overflow of the museum—that had been accumulating there for several decades. Many interesting objects saw the light of day for the first time in a quarter of a century, and among them was a wonderfully constructed, though somewhat damaged, design that suggested this paper. It was an elaborate wood and metal model of a Civil War hospital made for and exhibited at our Centennial Exposition. What at first glance attracted attention was the close resemblance between the constructional and architectural devices of the model and our recently built cantonment hospitals. It is chiefly to compare and contrast these that the present paper is written.

The material for this article is almost wholly taken from Part 3, Volume I, of our classic, Medical and Surgical History of the Civil War.

The principal illustrations have, however, been recently made from drawings and from photographs of original models in the Army Medical Museum, by the kind permission of Colonel Owen.

It is to be hoped that the whole subject, in view of the fact that our cantonment base hospitals are almost exact replicas of structures erected in this country during another great war over half a century ago, may form an interesting story for military surgeons and students of medical history.

There were 192 general and special United States hospitals in active service on December 17, 1864, distributed as follows (page 540):

The *largest* Civil War general hospitals, with their capacity in beds, are as follows: Harewood, 2,000 beds; Lincoln, 2,575, both at Washington, D. C.; Mower, 3,100 beds; Satterlee, 3,519 beds, these at Philadelphia, Pa.; Jefferson Hospital, Jefferson, Ind., 2,399 beds; Madison, Ind., a hospital with 2,430 beds; and U. S. General Hospital near Fort Monroe, 3,497 beds. There were also twenty-seven hospitals with a capacity of 1,000 to 1,800 beds.

When the Civil War broke out, little or nothing was known either by the medical profession or by the laity of any kind of military hospital. At first the only hospital in being was that of individual regiments. When need arose for medical shelter a large tent

was used, or a small house in the neighborhood was commandeered for the purpose. Later, when many regiments were encamped at some depot, a larger building—church, college, factory, warehouse, asylum, civil hospital or hotel—was utilized for the purpose. These buildings were in many instances not only reconstructed but additions were made to them as occasion required. One example of these converted buildings will suffice.

Departments	Number of hospitals	Bed capacity	Occupied	Vacant
Washington	25	21,426	13,865	7,561
Pennsylvania	18	18,709	13,412	5,297
Ohio	17	8,535	6,970	1,565
East	25	14,829	9,302	5,527
Northern	23	11,421	10,735	686
Middle	11	6,189	4,993	1,196
Northwest	4	2,532	2,034	498
Tennessee	10	3,055	1,263	1,792
Kansas	2	500	300	200
Cumberland	21	10,751	7,939	2,812
Missouri	8	3,462	2,638	824
Virginia and North Carolina	5	5,344	4,283	1,061
Gulf	8	5,808	1,991	3,817
South	4	941	605	336
Arkansas	6	1,517	1,101	416
West Virginia	5	3,038	1,978	1,060
Total	192	118,057	83,409	34,648

In 1861 the National Hotel, Baltimore, Md., became, under (then) Asst. Surg. W. A. Hammond, a most useful national hospital. Hammond points out that the needs and equipment of a hotel and a hospital are much the same. This hotel-hospital was five stories high, had fifteen wards and eventually housed and treated 700 patients at a time. This was the first hospital in which the very serious difficulty of transporting very sick patients up four or five flights of stairs was overcome by an elevator—an improvised dumb-waiter.

The first large, wooden, one-story structure provided with the now familiar ridge ventilation was built at Petersburg, Va. It was erected early in 1862 under the supervision of Asst. Surg. E. S. Dunster. This shed-like structure measured 130 by 25 by 14 feet to the eaves and was divided by transverse partitions into four wards of twenty beds each.

Shortly afterwards, groups of such buildings were erected in various localities, and although fault was found with the otherwise admirable "ridge" ventilation, because there were at first no transoms or other protection against severe rain, snowstorms or high winds,

yet the buildings themselves were soon found to be a great improvement over converted barracks.

There were many objections to reconstructed barrack hospitals. In the first instance, they were generally contaminated and insanitary, and could not be regarded as safe until large quantities of refuse filth had been carted away. Then, the insufficient water supply and the defective disposal of excreta, garbage, etc., were, from the hospital standpoint, often a serious stumbling block. Frequently, also, the rooms were too small or the ceilings too low for a row of ward beds; and where the buildings were of two stories the lower one generally suffered from noises made in the upper, as well as from improper ventilation. Finally, the separate buildings of a barracks were often too widely separated: in Camp Denison, Ohio, for instance, the ward on the right of the line was separated from that on the left by nearly a mile.

In the course of time a few buildings were originally erected for hospital purposes, but they were still modelled after the barracks system. The hospital at Hilton Head, S. C., was one of these. It was organized March 1, 1862, with a basis in an old building formerly used for hospital purposes by the Confederates. It was a single, narrow, barrack-like structure more than 1,200 feet long, the whole forming the sides of an enclosed quadrangle. The interior was reached by a large sally-port on two opposite sides and by other narrower entrances corresponding to the wards. The best feature about this hospital was its situation on the seashore, where it was exposed to the life-giving ocean breezes.

As a result of an agitation in favor of hospitals specially built for the purpose instead of made-over buildings of any sort, the Judiciary Square and Mount Pleasant hospitals were erected at Washington during the winter of 1861-1862. These buildings were raised on cedar posts about 3 feet from the ground, the intervening space being only partly covered. The two stories of the administration building were divided by a central corridor 10 feet wide. The details of the wards and the rooms attached to them at the corridor ends were much the same in each building.

All the parts of the wards were covered by a common roof, but as the partition walls were only 8 feet high there was a free, overhead communication between all parts of the building. At first the main wards accommodated only twenty patients, but this number was in time greatly increased. Later, also, the total capacity of the hospital was supplemented by tent pavilions. At Mount Pleasant fifty-seven of these were added, increasing the number of beds by 1,026.

The Judiciary Square wards were well supplied with windows. There were two sets, one (double-sashed) 6 feet up from the floor and one under the eaves, 3 feet square, moving on a central pivot. The building was not ceiled or plastered. The ridge roof ventilators were placed 10 feet apart. Surgeon Chas. Page says of this hospital that, although in most respects admirably adapted to the care of patients, it had some disadvantages. These were chiefly in the construction and situation of the privies and their communication, through the corridor over the partitions, with the air of the different wards. These defects were, to a large extent, remedied later. Still the great and fatal objection to the arrangement of wards in these hospitals was in the common atmosphere which the insufficient division of wards by mere screens covered by a common roof gave to all the rooms—even the isolation rooms—occupied by patients.

One of the worst contrived hospitals was that built at Chester, Pa. Its nucleus was a college building (used for administration and officers' quarters) from which extended five (two outer and three shorter inner) parallel sheds of rough boards, roofed with tarred paper. Each long structure was divided by two transverse partitions, thus converting the original building into three wards of 230, 190 and 205 feet, respectively. Owing to these and other peculiarties of construction ventilation was very defective, although the ridge ventilators were provided with shutters against snow and rainstorms. The location of the water-closets also was unfortunate; the only way in which they could be ventilated was through the wards.

During and after the year 1862 many and variously constructed hospitals having the pavilion feature were built, quite a few being erected about previously existing buildings, such as hotels, seminaries, etc. The later were utilized for administrative purposes, dispensary, quarters for officials, etc. Among these converted constructions were Summit Hospital, Delaware County, Pa.; Baxter Hospital, Burlington, Vt.; and Tilton Hospital, Wilmington, Del.

Of the numerous hospitals built on the covered corridor plan with an elongated space between them, the pavilions being attached along the outer side of each corridor, the large Satterlee Hospital at West Philadelphia is a good example. Here fourteen parallel pavilions, each 167 by 24 feet, were projected from each of the corridors at intervals of 21 feet, the passages being 70 feet apart.

In other similarly constructed hospitals, more space was allowed. At McDougall Hospital, Fort Schuyler, N. Y., there were seventeen wards on each of the corridors, but the latter were widely separated and ran into each other at one end in a semicircular curve. At

McClellan Hospital, Philadelphia, parallel corridors curved into each other at both ends, enclosing a large clear space. At Mower Hospital, in the same city, the enclosure containing the accessory buildings was enlarged laterally, while the fifty wards radiated from the outer margin of the corridor, forming a ground plan that approached in shape a square figure with rounded angles. In Jefferson Hospital, Jefferson, Ind., the covered corridors were arranged in circular order enclosing an area 600 feet in diameter. In this hospital the corridor was 16 feet wide and 2,000 feet long. There were twenty-four pavilion wards, each 175 feet long. The administration buildings were placed in the center, while at intervals of 46 feet on the outer aspect of the circle smaller-sized storerooms were disposed.

There were two varieties of ridge ventilation in Satterlee Hospital. The dimensions of one ventilator were: length, 136 feet; height above the roof, 3 feet 6 inches; and width (corresponding to the opening in the roof), 3 feet 11 inches. The sides were closed in bad weather by a series of revolving shutters, 3 feet long by 2½ feet wide, drawn by a cord. The ventilation of one series of eight wards was ridge ventilation proper. The ventilators extended the full length of the wards; the opening in the roof was 1½ feet wide, the elevation of the ventilator above the roof of the ward 8 inches, and the roof of the ventilator was 3 feet 6 inches in width on each side.

The hospital grounds were enclosed by a picket fence 14 feet high and covered 12½ acres. The buildings formed a parallelogram 815 feet long by 433 feet wide, the floor space taking up a little over 4 acres. There were 50 beds in each ward.

As the war advanced improvements were made not only in ward construction but in lighting, ventilation, the attachment of bathrooms and water-closets, and their arrangement as a whole, including the communication of one room with another—indeed in all the administrative and executive departments of the hospital. Lining, lathing and plastering, flooring with close-set tongued and grooved boards, weather-boarding externally and shingled roofs gradually supplanted the early, coarsely-joined and rudely-finished, paper-covered huts.

The open ridge, which at first admitted driving rains and snows, received protection, and other means of ventilation connected with the heating of the wards were introduced. Lastly, faults of aggregation were recognized and avoided. For example, the construction plans of Chester Hospital, which set all considerations of fresh air at naught, were not duplicated. On the contrary, the narrow inter-

spaces, which at many hospitals besides Satterlee were regarded as a source of danger in case of fire, had a tendency to become enlarged until, at the Jefferson Hospital, each hut, radiating from a circular enclosure, was at its free end separated from its neighbor by a space equal to four times its width and at its attachment to the corridor by a space more than twice its width.

The closed corridor, however, continued for a long time in every hospital plan to block up one end of the buildings and their interspaces, although the Armory and Stanton hospitals of Washington, D. C., built during the summer of 1862, showed that a covered pathway answered all the purposes for which a closed corridor was intended. It was, perhaps, the conversion of the corridor into a general dining-room at so many of the hospitals that ultimately caused its modification into a structure insusceptible of adaptation to undesirable uses. At all events, the covered walk, open at the sides, gradually displaced the enclosed corridor, thus giving better ventilation between the wards and a purer air in their interior from the side of the former corridor or mess-hall. At Stanton and Armory hospitals the pavilions projected from one side of the covered walk. Economy of space and centralization of labor were obtained at these establishments at the expense of ventilation and with increased risks from fire; the buildings were too close together, considering their great length and inflammable material, particularly that of their roofing. At Nelson Hospital, Camp Nelson, Ky., built at a later date but on a similar plan, the adjacent pavilions, although not so long as those of the Washington hospitals, were separated by a space of 35 feet.

At Hampton Hospital, Fort Monroe, Va., the pavilions were arranged *en echelon* in the form of a V, with the administration buildings, quarters and store-rooms closing in the triangle, and the kitchen and dining-room in the enclosed space. As each pavilion, in receding from the angle, was disposed lengthwise behind and external to that in front of it, the length of the diverging series of wards was found to be an inconvenience. A similar inconvenience was experienced at Lowell Hospital, Portsmouth Grove, R. I., where on account of the nature of the ground, the pavilions were arranged in two lines, with a covered pathway along the middle of the wide avenue between them. At Harewood and Lincoln hospitals, Washington, D. C., where the V-shaped plan obtained, the distance of each diverging line of wards from the administration building at the apex was reduced by making one pavilion overlap the other. The circular plan, with an open corridor, was used in the construction of Hammond Hospital at Point Lookout, Md.

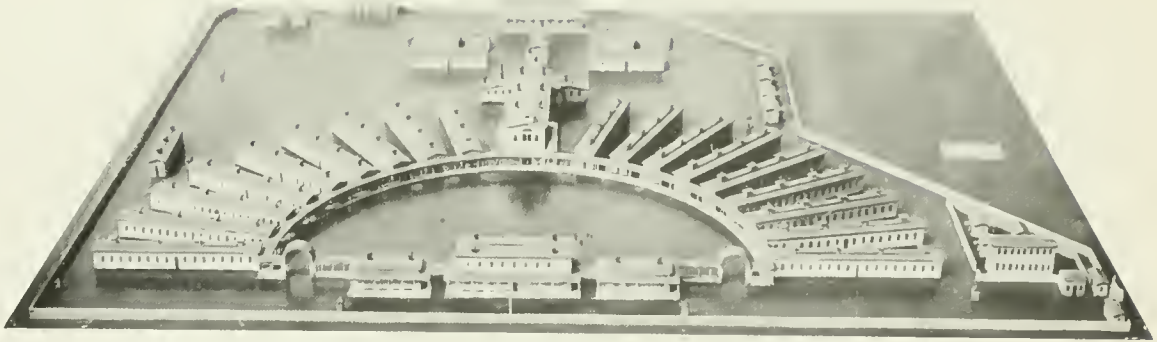


FIG. 1.—PHOTOGRAPH OF MODEL, HICKS HOSPITAL, BALTIMORE, MD.

This hospital of eighteen wards projected from a covered corridor with a semicircular plan. In front is the administration building. This was one of the most substantial and most satisfactory of the Civil War hospitals. It was built and ventilated as required by the War Department regulations, set forth in the text of this paper. (Army Medical Museum.)

(To face page 541.)

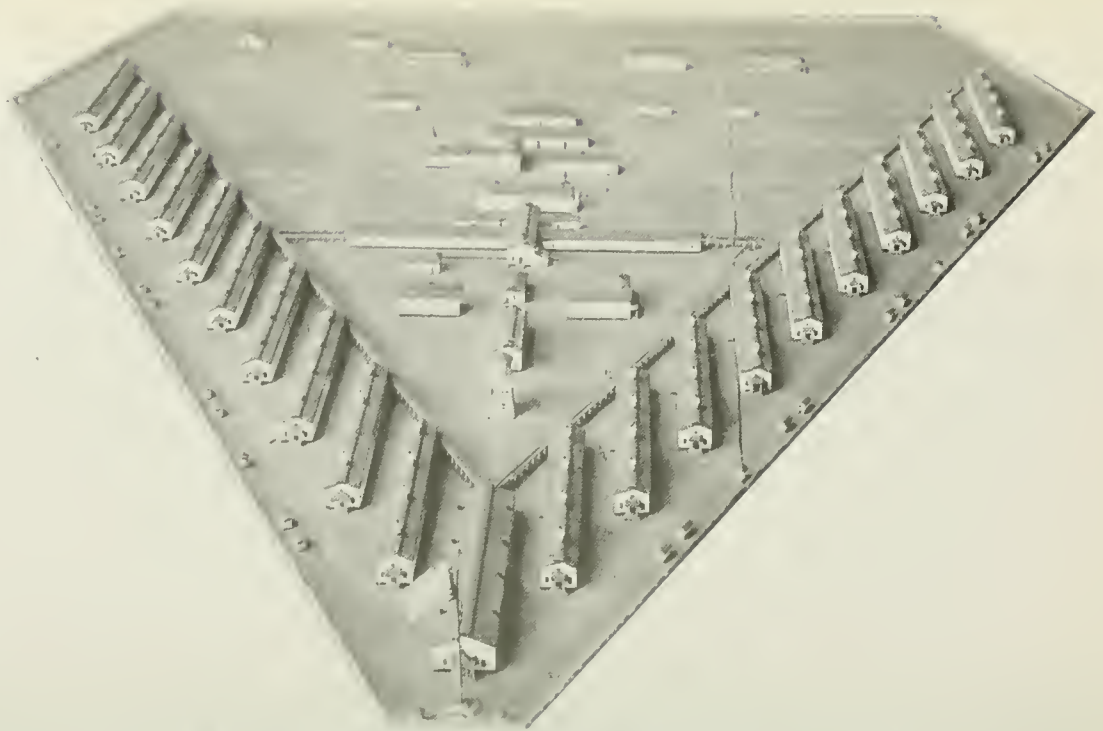


Fig. 2.—Model of Lincoln Hospital, Washington, D. C. V-type of Civil War Hospitals

Hampton Hospital, Fort Monroe, as well as Lovell Hospital, Portsmouth, R. I., and Harewood Hospital, Washington, D. C., were also built on this general plan. The administration building and other annexes were placed within the arms of the V. They were themselves joined by covered corridors. The wards were also united by covered ways, which joined the wards arranged *en echelon*. (Army Medical Museum.)

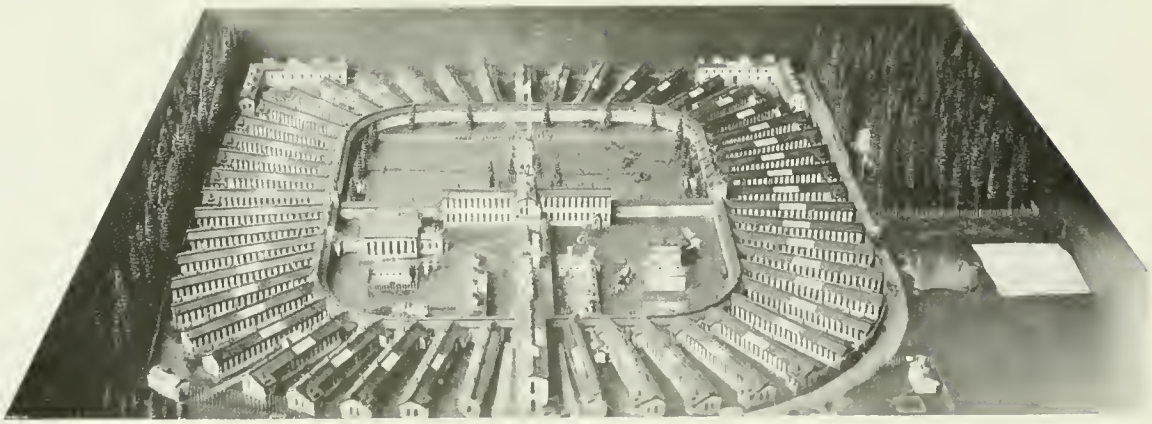
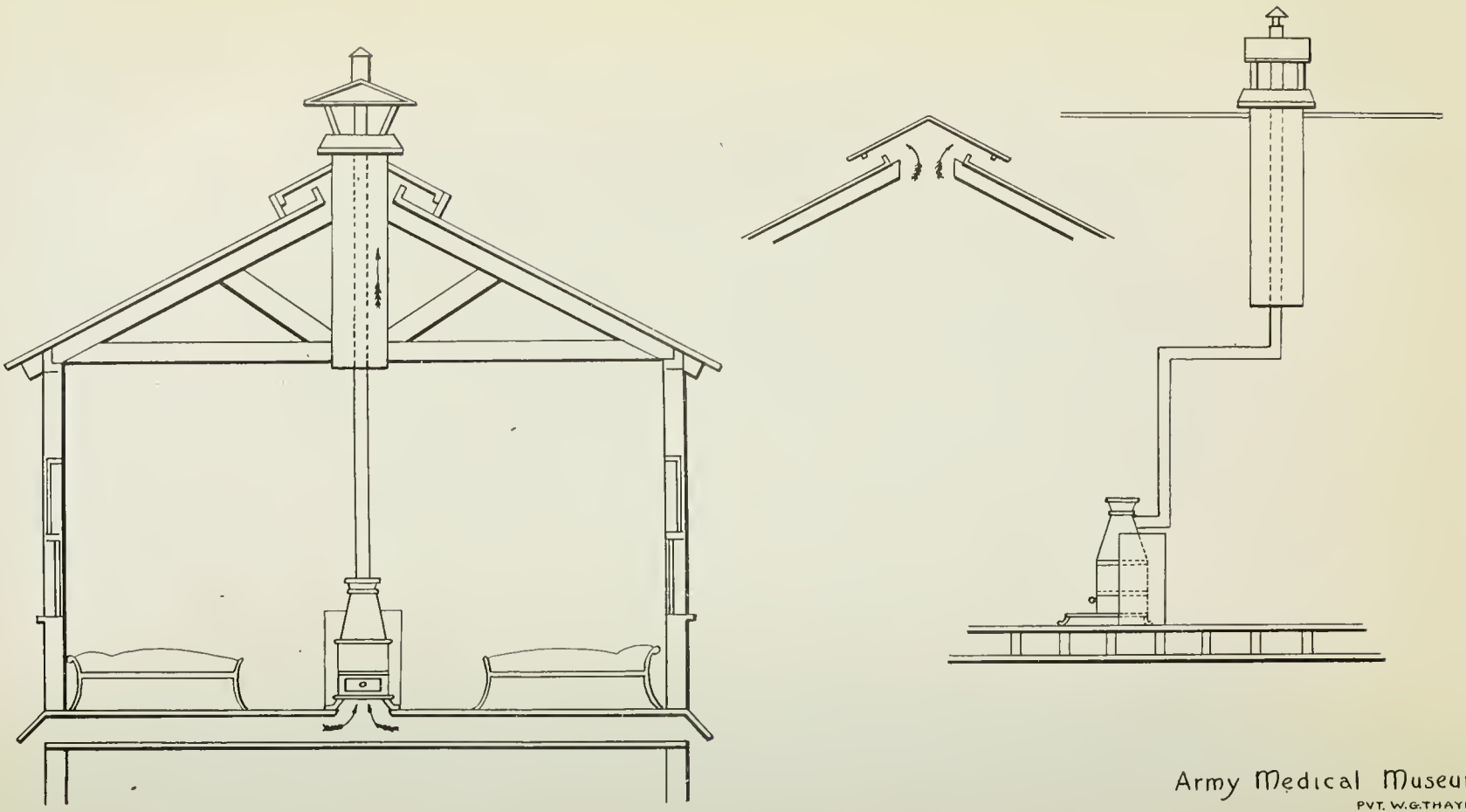


FIG. 3. —MODEL OF MOWER HOSPITAL, CHESTNUT HILL, PA.
This large, circular construction of fifty pavilions, some at right angles, others oblique to a central corridor, was opened in December, 1862. The administration building and other annexes are in the center. (Army Medical Museum.)



Army Medical Museum
PVT. W.G.THAYER
MARCH 29-18

FIG. 4.—SCHEME OF VENTILATING AND HEATING THE WARDS OF CIVIL WAR HOSPITALS.

Four stoves were, as a rule, allowed to a ward. These were surrounded by a zinc or sheet-iron jacket with an air-box opening below to supply fresh air. During mild weather, the wards were ventilated directly by the ridge. During winter the ridge was closed and ventilation carried on by shafts.

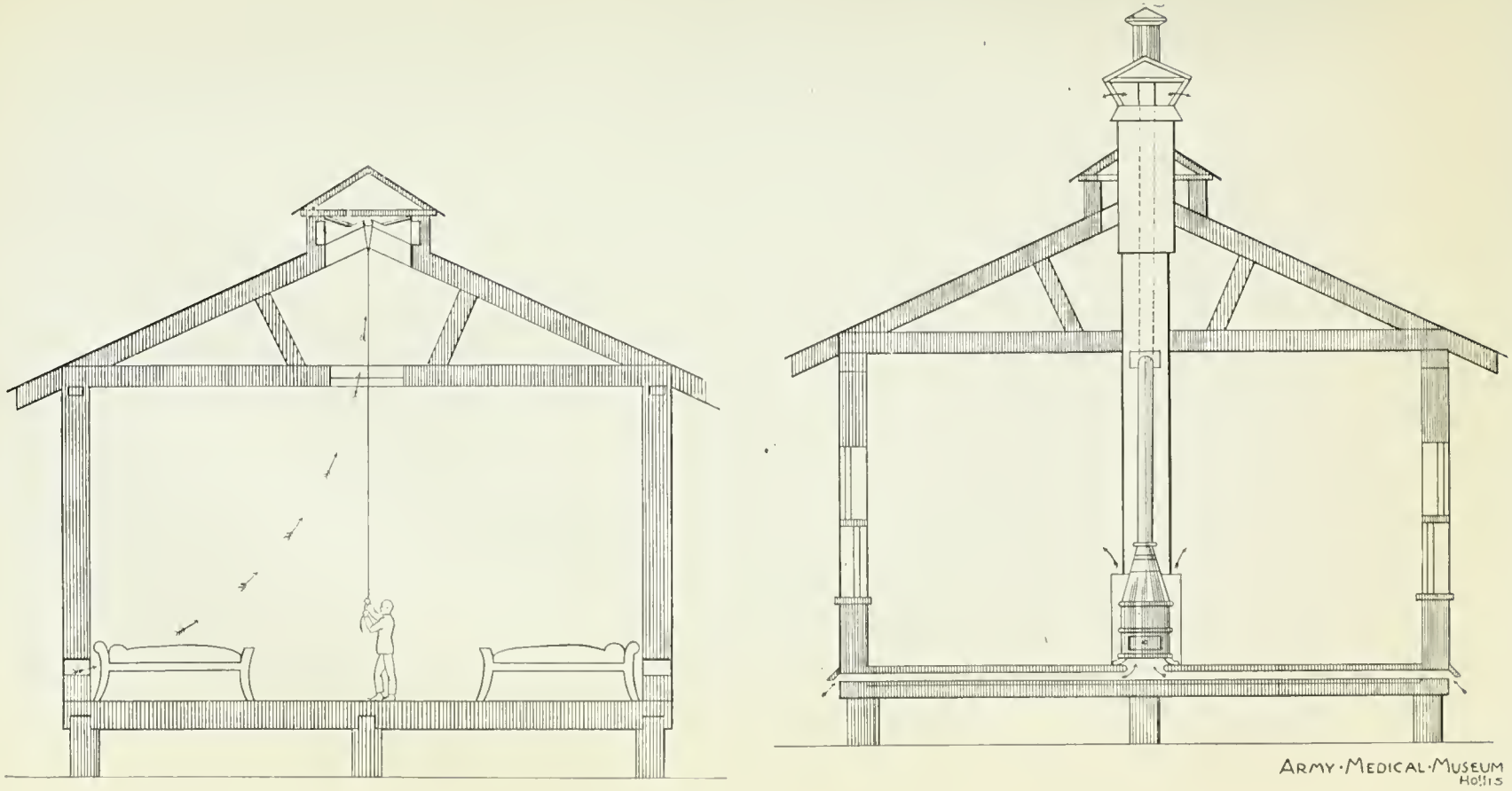


FIG. 5.—SEDGWICK HOSPITAL, GREENVILLE, LA

Ward ventilation and heating. The two figures show the method of opening and closing the ridge shutters and the arrangement of the stoves and shafts for warming the wards in winter.

An important part of ward equipment was the *heating apparatus.* The plan both of warming and ventilating Sedgwick Hospital is shown in the accompanying Figs. 4 and 5.

The instructions issued by Secretary Stanton on July 20, 1864, to officers charged with the construction of general hospitals were carried into effect in most buildings subsequently erected, and were the basis of a remedy for defects in others previously built. The instructions covered, among points, the following specifications:

Site.—The site of the hospital should be a well-drained plain, with a subsoil of gravel, and sufficiently extensive to accommodate the buildings. The situation should be elevated; as remote as possible from marshes or other sources of malaria, and must have a convenient supply of pure water.

Plan.—General hospitals will be constructed on the principle of detached pavilions, each ward being in a separate building, with beds for sixty patients. Besides the wards there will be detached buildings for each of the following purposes: General administration buildings, dining-room and kitchen for patients, dining-room and kitchen for officers, laundry, commissary and quartermaster's store-house, knapsack-house, guard-house, dead-house, quarters for female nurses, chapel, operating room and stable. The wards, administration building, kitchens, dining-rooms and chapel are to be connected by covered walks which will have floors but no sides.

No general plan for the arrangement of the buildings can be directed, as the varying character and dimensions of sites render an uniform adherence to any one impracticable. Wards may be arranged *en echelon* in two converging lines, forming a V. In this case the administration building should be at the apex of the V, the other buildings between the wings; or as radii from the periphery of a circle, ellipse or rounded oblong. In this case the administration building should be one of the radii, the other buildings within the enclosure or parallel to each other. In the last-named case the administration building should be in the center of the row, the other buildings in the rear. Other plans may be rendered necessary by the special features of the ground. In any case the important points to be observed are to place the buildings far enough apart (at least 30 feet should intervene between two parallel buildings) and to locate them in such a manner that no one shall interfere with the ventilation of another. It is preferable to locate the wards so that the long diameter may run north and south or nearly so.

Each *ward* will be a ridge-ventilated pavilion, 187 by 24 feet. At each extremity two small rooms, 9 by 11 feet, one on each side of the passage, 6 feet wide, will be partitioned off. The space remaining for patients will be 165 by 24 feet. The small rooms are occupied as follows: Chief nurse; closet for medicines, etc.; bath-room; closet for close-stools.

The wards will be 14 feet high from the floor to eaves, the pitch of

the roof to vary in accordance with materials composing it. The floor is to be elevated at least 18 inches from the soil, with free ventilation beneath it. A ward thus constructed will accommodate sixty patients, allowing more than one thousand cubic feet of air-space to each. The number of wards will be regulated by the number of patients the hospital is intended to accommodate. A hospital of twelve hundred beds will require twenty wards.

Administration Building.—For a hospital of six to twelve hundred beds this will be a ridge-ventilated building, 38 by 132 feet and two stories high; the first 14 and the second 12 feet high in the clear. This building contains the general office, office of surgeon in charge, linen-rooms and store-rooms, dispensary, chaplain's office, lodging rooms for officers, etc.

Dining-room and Kitchen for Patients.—The dining-room will be a ridge-ventilated building, large enough to seat a number equal to two-thirds the number of beds. The most convenient form is a long parallelogram, into which the kitchen opens in the center of the long side. The kitchen will be divided into two unequal parts—the larger for the preparation of ordinary diet, the smaller for the extra diet—the cooking in both to be done on ranges. Where there is an engine, steam may be advantageously used for boiling.

Dining-room and Kitchen for Officers.—A small building for this purpose will be situated near the administration building.

Laundry.—A building two stories high, with lodgings for the laundresses on the second floor. The roof should be flat, with posts for stretching clothes-lines.

Commissary and Quartermaster Store-room.—A small two-story building, furnished with boxes and shelves for the various parts of the ration, having an ice-house connected with it for the preservation of meats and other perishable articles and a room for clothing; the second story to contain lodging rooms for the cooks.

Knapsack-house.—A building to receive the effects of the patients while in hospital. It will contain as many pigeon-holes, each 2 feet square, as there are beds in the hospital.

Guard-house.—A detached building to lodge the guard, with a guard-room for prisoners.

Dead-house.—A small building containing two apartments, located so as not to be observed from the wards, and lighted with skylights.

Quarters for Female Nurses.—A detached building, containing lodging rooms, dining-room and kitchen for the female nurses.

Chapel.—A detached building, fitted for the purpose of religious services, so arranged as to be used also as a library and reading room.

Operating-Rooms.—Two rooms, each 15 feet square, one well lighted by skylights, the other by windows; the first for surgical operations, the second for discharge boards, etc. It should be situated near the administration building.

Stable.—For ambulance and officers' horses.

Water Supply.—Where practicable, a large tank will be erected and

engine. The engine, if possible, will be situated near the kitchen and laundry, in which case the steam may be made serviceable in cooking, and the power may be employed in working the washing and mangling-machines.

Sinks.—Where the supply of water is adequate, water-closets may be constructed in one of the small rooms in each ward; but where this is not so, privies will be built at a convenient distance from the wards, furnished with water-tight boxes, which must be emptied every night.

Ventilation.—During warm and mild weather the wards will be ventilated by the ridge, but during winter the ridge will be closed and ventilation by shafts substituted. Four stoves will be allowed to a ward, each partly surrounded by a jacket of zinc or sheet-iron, with an air-box opening beneath it to furnish the supply of fresh air. At 8 feet from the stove will be a shaft, properly capped, through which the stove-pipe will ascend. The shaft should be 18 inches square and should not come below the tie-beams. (See the figures.)

Students or even casual observers of our cantonment hospitals will have noticed the striking likeness between our division base hospitals and those just described. That the former structures are well adapted to the present day purposes for which they were built no one will deny, but in one particular the Civil War general hospital of the later type of construction had the advantage, viz.: in its heating plant. Wood-burning stoves constituted a sanitary, readily controlled and certain means of ward heating, while a central plant, such as was recently installed in our divisional base hospitals, showed radical defects that often issued in overheating when heat was little needed and in the lack of it during periods of zero weather.

An attempt to profit by this experience and secure the advantage of stove heat in a modern hospital recently constructed on the one-story pavilion plan is seen in U. S. General Hospital (Columbia) No. 1. Here large coal-burning stoves are employed and the arrangement has proven satisfactory so far as warming the wards is concerned, but it is a question whether the use of coal (carried into the middle of a ward), with the consequent dust and the formation of gases that are not always controlled by ventilation, is not a serious drawback from a hygienic standpoint.

In a discussion of instructions for the guidance of hospital constructors the writer, in the Medical and Surgical History of the War, raises the vexed question of the best locality for ward toilets. As a matter of fact the instructions were not closely followed in the relative disposition of the water-closet, the lavatory and the bath-room, the pantry, the wardmaster's room, the ventilating hall and the passageways to the ward proper. Some kept supplied from wells or springs by pumps worked by a steam-

authorities suggested placing some of these at the free end of the ward. But it is urged by the writer that the advisability of closing in the free end of the ward by service rooms of any kind may be seriously questioned, as their apposition deprives that point of the building of all the advantages of exposure to sunlight and air which its position as a free end would otherwise confer upon it. A better site for the water-closet and bath-room of pavilions connected by a covered walk might have been found *across the corridor* from the attached end of the ward.

The *water supply* was not infrequently a weak spot in Civil War hospital management; often because the disposal of sewage usually depended upon flushing the troughs and pipes containing the excreta in those cases in which deep pits or vaults were not used. Where the supply of water was abundant little trouble was entailed, but when it was found necessary to economize, the deposits were retained in the troughs for several hours, and the odors from toilets of this class penetrated to the wards unless the closet itself was thoroughly ventilated and separated from the body of the building by a cross-ventilated passage.

Provision against fire was very complete in these early hospitals. Fire drill and a special fire patrol were maintained, while buckets kept filled with water, fire-axes and rubber hose (attachable to near-by plugs) were placed in every ward. As a matter of history, in spite of the highly inflammable character of the Civil War hospitals and their contents, very few serious fires occurred—an exact parallel with the experience of our present cantonment buildings.

Medical cadets were a feature in Civil War general hospitals. These were young men, students of medicine, who were employed as clerks and dressers under the ward physician. In other respects the regular personnel of the average general hospital in 1864 was about the same, with much the same duties, as those of a division base hospital in 1918.

Female nurses, contrary to the usual belief, were borne on the rolls of many of these hospitals. For example, in West's Building, Baltimore, twenty of the seventy nurses were women; at Stewart's Mansion, fifteen out of seventy. Forty Sisters of Charity nursed patients at Satterlee, sixteen at Point Lookout, and so on.

There was a *slush fund*, varying in amount from less than $100 to as much as $400 (DeCamp) a month, which was expended for such articles as the surgeon in charge deemed advisable—a library for officers and patients, musical instruments, entertainments, printing press—just as is done today.

A STUDY OF THE COMPARATIVE NUMBER OF SUCCESSFUL VACCINATIONS BY THE CROSS-SCARIFICATION AND THE INCISION METHODS[1]

By Major E. D. KREMERS

Medical Corps, U. S. Army

WHILE on duty at Fort McDowell, California, the Pacific Coast Recruit Depot of the Army, an excellent opportunity was afforded for observing the methods and immediate results of smallpox vaccination in army recruits. Not only were the recruits enlisted at Fort McDowell subject to close inspection for evidence of successful vaccination but, in addition, a large number enlisted at the other recruit depots were received at Fort McDowell, awaiting transportation to overseas garrisons; all these were inspected and those who showed no evidence of successful result were revaccinated.

It soon became apparent that the subject of vaccination against smallpox was not receiving the attention which it deserves. For example, various techniques were being employed, in spite of the directions issued by the War Department which fixed the necessary technique and prohibited other techniques. Cross-scarification, hit-or-miss linear scarification, and improperly controlled linear scarification were generally in use. The number of "sore arms" following vaccination was large.

As a result of communication with medical officers of experience, the opinion was gathered that the reason for failure of compliance with the prescribed method of vaccination was the popular impression that this method was not as effective in "takes" as the old cross-scarification method and that some medical officers believed it better to use the old method and satisfy their minds that their men were protected than to use the new method, the protective value of which they were in doubt. There appeared to be no data at hand showing the comparative results of vaccination by the two methods done under like conditions and, for the purpose of securing such records, a study was made of the vaccination of the recruits enlisted at Fort McDowell from July 10, 1916, to January 20, 1917, inclusive. At

[1]The attitude of the Medical Department of the Army towards a method of vaccination, as indicated in various editions of its manual, has varied from a very precise method, laid down in the edition of 1902, through the several manuals since issued, each less definite, until the circular of 1917, which practically reiterates the requirements of 1902. It might seem that if anything could be settled by long experience, the proper method of vaccination should be.—Editor.

the end of this period the results appeared to be sufficient, and after that time vaccinations by the prescribed method only were done.

During this period the vaccinations of 1,520 recruits were carefully observed and the results noted. A much greater number than this was vaccinated but a great many of these men were transferred before the results could be finally determined.

Method of Study.—Each day when the recruits were ready for vaccination, careful data was obtained from each man and set down on paper with the name of the recruit, which covered the following points: The date; the date of previous successful vaccination, if any; a history of smallpox—careful questioning attempted to differentiate between a history of smallpox and of chickenpox; a careful search for scars of successful vaccination and of smallpox; the age; the places of previous vaccination or of residence, with special reference to rural or urban residence; the reason for previous vaccination or for failure to be vaccinated; dates of previous unsuccessful vaccinations; the method of vaccination; the results.

The site of vaccination was washed with soap and water and at first with alcohol. Later, it was found that washing with soap and water alone gave as good results as followed the addition of alcohol, and its use was discontinued. Each day the recruits were divided and one-half vaccinated by the old method and one-half by the prescribed method. Aside from the method, similar conditions were observed in each set.

When cross-scarification was used, the area was made ¼ inch square and two squares were made about 2 inches apart. When linear scarification was used, the lines were made ¾ inch long and 1 inch apart. A needle was used in both cases, flamed before use. A few vaccinations were done with dry vaccine on points, but practically all were done with glycerinated vaccine in capillary tubes. No dressing was used except in a few early cases.

Examinations were made at the end of twenty-four hours, for the "reaction of immunity," at the end of seventy-two hours and at the end of one week.

Vaccinations were marked positive or successful and negative or unsuccessful, and no case was regarded as positive unless the vesicle was typical and ran the course of true vaccinia. Accelerated reactions in previously protected men were marked positive if the vesicle followed the course typical of successful revaccination.

Of the 1,520 vaccinations noted during the period given above, 482 were in men who had never been previously successfully vaccinated, who had no history of smallpox and who showed no scars of

either vaccination or smallpox. If any scars were found which might possibly be the results of vaccination, the case was not counted. Many of these men were of foreign birth and could not be relied upon to give trustworthy information which would be of aid in determining doubtful cases.

Of the 482 cases included in this report, only 90, or 18.7 per cent, had had a previous application of vaccine virus, and it must be concluded that this body of men represents as virgin material as could be secured in the Army, and should make the results obtained of greater value than if the proportion of men in whom vaccination had previously been tried were greater.

Results of Study.—The following table shows the number of "takes" and the percentages. Relatively the same proportions existed throughout the study, and, while a larger series of cases would undoubtedly give some difference in the percentages, it is believed that the variation would not be great.

TABLE 1.—*Percentage and Number of "Takes" in Unvaccinated Men Who Have Not Had Smallpox*

	Cross-scarifications			Linear scarifications		
	Successful	Unsuccessful	Per cent	Successful	Unsuccessful	Per cent
First vaccination (primary)	201	24	89.3	208	49	80.9
Second vaccination	7	.....	92.4	13	.....	85.9
Third vaccination	0	.....	92.4	2	.....	86.7
Fourth vaccination	0	.....	92.4	1	.....	87.1
Total	208	17	92.4	224	33	87.1
Total cases	225	.....	.....	257	.....	.....

Discussion.—There is a slightly greater number of "takes" in vaccinations done by the old method over the modern method. This is to be expected, for it is apparent that the larger the absorptive surface presented for the entrance of vaccine virus, the greater the opportunity for absorption. The one incision, ¾ inch long, gives only ¾ inch of absorptive surface in length. In a square ¼ inch of cross-scarification, if there were five scratches each way, there would be 2½ inches of incision, and if there were four each way there would be 2 inches, approximately. When the vaccine is relatively inert, this might be an important factor in the success or failure of the vaccination. The amount of vaccine applied to the surface is also a factor, and it is also apparent that there is greater

opportunity for absorption when the vaccine is applied to a cross-scarified area where there are several minute crosses closely situated than there is when the same amount of vaccine is drawn over a line of minute abraded points. This difference is, however, relative and not of great practical importance, as the results in the table above show.

In this table there is also shown a greater disproportion between primary "takes" than there is between secondary and total "takes." This may not be of real significance, for where re-vaccinations are done it would appear that the results answer all practical needs. The table is not perfect in this regard because only a portion of the primary "failures" were held long enough to carefully re-vaccinate.

The following table shows the number of "failures" who were re-vaccinated:

TABLE 2.—*Revaccinations*

	Cross-scarification			Linear scarification		
	Number vaccinated	Successful	Unsuccessful	Number vaccinated	Successful	Unsuccessful
Second vaccination.....	13	5	8	34	11	23
Third vaccination.....	4	0	4	21	2	19
Fourth vaccination.....	3	0	3	9	1	8

Thus, of 24 primary "failures" by the first method, 11 were not included in the revaccinations, and of 49 primary "failures" by the second method, 15 were not included in the revaccinations. The percentages of secondary failures and tertiary failures not re-vaccinated were also considerable, and the percentages of total "takes" would probably be higher if a "perfect" list of re-vaccinations could have been made.

On theoretical grounds there appears no reason why all unvaccinated individuals should not "take" on vaccination or re-vaccination. The element of chance in faulty technique, poor vaccine, etc., might affect the same individual in successive vaccinations, and perfection can rarely be attained. When practically 90 per cent of "virgin" individuals are successfully vaccinated, however, epidemics need not be feared, and this percentage is attained by both of the methods used in this study.

The Reason for Failure of Vaccination.—A satisfactory expla-

nation for the failure to successfully vaccinate unprotected individuals, even after repeated trials, has never been made. There appears to be some reason why a certain percentage do not "take" and Force[2] has studied this subject. An extended discussion of this feature cannot be made in the scope of this paper. Force states that some of these individuals show a "reaction of immunity" (immediate reaction of Von Pirquet) which he ascribes to the presence of antibodies induced by repeated small doses of virus, insufficient to cause growth but capable of producing immunity that is analogous to that produced by a vaccine made from a killed culture.

Of the 73 primary "failures" included in Table 1, 54, or 73.9 per cent, had never been vaccinated, according to their statements. Most of these men were young Americans of rural residence, and it must be believed that their statements were substantially correct. Nine of these 54 showed a "reaction of immunity," the areola shown at the end of twenty-four hours being ¼ inch or more in radius from the incision or outer edge of scarification. Of the 19 primary failures who had previously been vaccinated, only three showed the "reaction of immunity." These men had been vaccinated unsuccessfully in 1902, 1913, and 1916, respectively.

Three men who failed to show a "reaction of immunity" were vaccinated six consecutive times without a "take." One man who showed a "reaction of immunity" was also vaccinated six consecutive times without a "take," and another five consecutive times without a "take." On the other hand, one man who showed a reaction was successfully vaccinated on the third trial. It appears that there are some individuals who show no "reaction of immunity" and are still very resistant to vaccination. The consideration of a natural immunity to vaccine virus at present can only be speculative.

TABLE 3.—*Primary Failures*

	Showing "reaction of immunity"		Not showing reaction of immunity	
	Successful	Unsuccessful	Successful	Unsuccessful
Second vaccination	0	8	16	23
Third vaccination	1	6	1	17
Fourth vaccination	0	5	1	6
Fifth vaccination	0	3	0	4
Sixth vaccination	0	1	0	3

[2]Force, J. N., *Journal of the American Medical Association*, May 9, 1914.

Force reports 78.4 per cent of "takes" in 333 persons done by scarification of an area about 5 mm. square. He reports 82 per cent of "takes" in 326 persons done by circular scarification with a Von Pirquet chisel. Both of these results were in "unscarred" persons.

Methods of Vaccination.—The following methods of vaccination are rather generally in use:

1. *Cross-scarification.*—The advantage of this method is the large percentage of primary "takes." In my series of 225 unvaccinated men the percentage of "takes" was 92.4 per cent. The great disadvantage of this method is the well-known prevalence of "sore arms" or infections which follow. This is believed to be due to the coalescence of a ring of vesicles around the abraded area leading often to necrosis of the central area and deep-seated infection. Sloughs and slow-healing ulcers result and terminate in the large scars which formerly were considered typical of successful vaccination. This method has been prohibited in Germany since March 31, 1897.[3]

Force[4] calls attention to the large number of improper or careless vaccinations done at their homes on pupils leaving for University attendance.

I have records of 19 large ulcers following this method of vaccination at Fort McDowell from June 7 to September 9, 1916. In addition to these there were many other infected arms. Infections and ulcers may follow other methods, but they are rare. I have observed two cases in which ulcers followed vaccination by the linear incision method. These are never as large nor as slow healing as the deep circular ulcers of the old method. The infections following the cross-scarification method far outweigh in importance the slightly greater percentage of "takes."

2. *Rotary scarification* with the Von Pirquet chisel. This method has not been tried by me; it is used by Force, though the percentages of "takes" he reports are not as high as those secured by the linear method in my cases. As now used in California, the abrasion is made with one flip of the chisel.

Force uses and advises three insertions and has concluded that this method gives the surface area of scar considered necessary by the Local Government Board of England. As the abraded area of this method is wider than that made by incision it is theoretically more apt to lead to infection than the incision method. Vesicles

[3]Rosenau, M. J., *Preventive Medicine and Hygiene*, 1916.

[4]Force, J. N., and Stevens, Ida M., *Journal of the American Medical Association*, lxviii, p. 1247.

may develop on the extreme edges of the abrasion and, as they grow, they coalesce, and the resulting vesicle is wider than that which grows from a single vesicle. The incision method is, therefore, believed preferable as it is more easily controlled.

3. *Abrasion* of a square area of ⅛ inch. This is advised by Kolmer and is much like the preceding.

4. *Acupuncture* through a drop of vaccine. This is said to be a painless and very useful method in children, but the absorptive area is small and with inert virus is not effective.

5. *Incision.*—This is the only method permitted by the laws of Germany and is recommended by the Local Government Board of England. Dock[3] long ago called attention to the desirability of this method, his vaccinations having been done with a scalpel. Rosenau advises the use of a needle and this is believed to be much preferable. Too deep incisions can be easily avoided and the needles can easily be flamed before and after use. This is the only method which should be used in the military service. The directions for its use are given in Special Regulations No. 28, War Department, 1917, as follows:

Technique.—The skin at the selected site must be clean. Washing with warm water, followed by alcohol, is usually sufficient, the alcohol being permitted to evaporate before proceeding. Scrubbing with soap and water is necessary for a dirty skin, but needless irritation of the skin is to be avoided.

The procedure, described as follows, is preferable to "Scarification," which will no longer be used.

Incision is the method of choice, and should be made with the point of a sterile needle, producing a "scratch." A sterile scalpel may be used, but is more likely to cause bleeding. The incision or scratch should preferably not draw blood. There should be at least two incisions, ¾ of an inch long and 1 inch apart; after exposure to smallpox four incisions will be made. The virus is then placed upon the abraded surface and gently rubbed in, unnecessary irritation being avoided.

The wound is allowed to dry thoroughly and can be left without dressing, though several layers of gauze may be applied with adhesive plaster. Any dressing that retains heat and moisture is bad. Shields will no longer be issued.

Bathing is permitted, but unnecessary use of the limb is to be discouraged when practicable.

Special Precautions.—(1) Vaccination as done in the military service must be under the direct control of a medical officer who should be charged with the proper performance of this work. No

[3]Dock, George, *Modern Medicine*, Osler, McCrae, vol. i, 1913.

departure from the method in any important point should be allowed. The method should be printed on cards so that it is constantly before the personnel on duty where vaccinations are done.

2. When arms are scrubbed, an antiseptic liquid soap and pledgets of sterile absorbent cotton should be used. A hand brush should never be used for scrubbing, as this produces minute abrasions on which vesicles form outside of the line of incision and coalescence of these vesicles leads to the same bad results seen in the scarification method.

3. Only one scratch should be made for each incision. Re-scratches are bad.

4. It should be impressed upon all medical personnel that careless attention to the technique of vaccination may lead to serious infections which render the men noneffective for considerable periods.

5. No dressing should be used after vaccination unless the vesicles become broken or infection is present. The gauze dressing acts as an abrasive when the arm is rubbed.

6. Force[6] has investigated the comparative results of vaccinations done with and without the use of antiseptics as advised by Schamberg, Dyer and others. He concludes that "the course of a primary vaccinia is apparently uninfluenced by treatment with antiseptics."

Conclusions.—(1) The method of incision is the only vaccination method which should be used in the military and naval services. It should be the method of choice for all vaccinations.

2. The cross-scarification method gives a slightly higher percentage of primary "takes' than the incision method and a reduced higher percentage of total "takes" (re-vaccinations included) in unprotected persons.

3. 87.1 per cent of total "takes" were secured in 257 unprotected men by the incision method against 92.4 per cent in 225 unprotected men by the cross-scarification method.

4. The percentage of "takes" secured by the incision method is sufficient when carefully done to prevent epidemics of smallpox.

5. The slightly higher percentage of "takes" secured by the cross-scarification method is offset by the increased number of infections which follow this method.

6. Medical officers should be assured of the protection against smallpox afforded by vaccination carefully done by the incision method.

[6]Force, J. N., and Stevens, Ida M., *Journal of the American Medical Association*, lxviii, p. 1247.

EDITORIAL

ADVANCED RANK FOR THE MEDICAL CORPS OF THE ARMY

In a recent hearing before the Military Committee of the Senate, on the proposition to fix the grades of army medical officers in accordance with a definite percentage of their number, which number is now prescribed by law as seven per thousand of the fighting effective, it might appear that certain important points were overlooked, the most essential of which being the value to the country and service of the proposed law. Something was said of its cost but little convincing of its worth.

No one would question for a moment the desirability of having the most efficient medical department possible in our army no matter the cost, for nothing costs more than inefficiency. Assuming that every individual medical officer in the corps were universally acknowledged to be on the highest professional plane, a veritable medical expert, would such necessarily result in the highest medico-military efficiency? By no means. This aggregation of talent would have to be organized into a team, officered, disciplined and trained as a team, before it could be efficient in a military sense.

Now, discipline, training and coördination are fundamental to an army; they have been the primary objects of attainment in the formation of all armies and must continue to be, so long as armies shall exist. To attain these objects leadership is requisite and this leadership must reach from the molecule of the squad up through its various aggregations until merged into the mass of an army, with a supreme leader.

Military experience teaches that these leaders must be definite in grade and number, beginning with lance corporal and ending with field marshal. The lance corporal may command seven men and the field marshal seven millions; certainly there can be no question as to the relative responsibility, authority and influence of these two officials; moreover if this difference were not necessary, it would not be permitted to exist, for many reasons, and it does exist.

An army is a complex organism, every part of which must be organized and trained along the same fundamental lines, if the work is to be coördinated and an efficient team result. In a word, given so many men we need so many officers and given so many officers they must be divided proportionately among the different grades from the lowest to the highest; this applies equally to the

staff, where the command of troops is involved, as well as the line.

Without being specific as to the strength of our forces, present or prospective, we shall by way of illustration, assume that Congress proposes to organize an army of a million and is seeking to authorize the most efficient medical department for this force. For the purpose of this discussion, we shall confine ourselves to the requirements of the medical corps, commissioned and enlisted.

Under existing law and regulations this army would have seven thousand commissioned and 50,000 enlisted sanitary troops. These are the bald facts. Assuming that these sanitary troops must be organized in a military way, a perfectly reasonable assumption, how would any trained military man organize them? As our military organization has wobbled somewhat, we shall go to the British army from which we descend, for our analogy. The time-honored unit of 1,000—about the largest number any one man personally has been able to lead efficiently—is, in the British service, commanded by a lieutenant colonel; four of these battalions, so named, are supervised by a brigadier general and four of the brigades, 16,000 men, constituting a division, are directed by a major general; then two corps under lieutenant generals and possibly all under a general. So, without going into details of the lower grades, we find British experience teaches that 50,000 men, to be properly managed, should be divided into thousands, each thousand to be supervised by an individual designated lieutenant colonel, with subordinate officers; each four thousand by one called a brigadier general; each sixteen thousand by a major general, etc. This service has medical generals, cavalry generals, artillery generals, engineer generals, etc.; nor are any of these postions sinecures, they are usually occupied by men of ability whose services their government rewards adequately.

The analogy in civil life is perfectly apparent; the supreme director of 50,000 railroad employes looms large in the business world, carries great influence and his services demand large remuneration—which the stockholders would not pay if such were unnecessary. His subordinates are graded and rewarded proportionately.

From the foregoing and reduced to its simplest form, in this hypothetical army the first duty of the medical department is to organize itself as an efficient military team, in the way that military experience dictates. This it cannot do unless Congress shall help. To be sure it might, with the same help, organize in the way that railroad experience dictates, but then it would not be a military team. Of course it requires certainly no less effort and ability to

train and direct a sanitary soldier than it does any other soldier and if the methods employed in one case are necessary, they are equally so in the other.

In addition to the total responsibility for the sanitary troops, the medical corps at once becomes wholly responsible for an increasing number of men from the other branches of the service who, when they fall ill, are the immediate charge of that corps. The averages number of these is determined by long experience and as the war progresses, will hardly be less than 10 per cent or one hundred thousand, of our hypothetical army of a million.

Now these hundred thousand invalid soldiers require, *mutatis mutandis,* care, supervision and control as soldiers and such should be given by officers of like standing with the officers under whom the men have been serving, if the best results are to follow. There is no getting away from this fact. It is trite to say that the chief function of the medical department is to strengthen the fighting line, everybody knows that, and part of this strengthening is the maintenance of the military atmosphere while the sick soldier is being restored to fighting conditions. This is perfectly compatible with the most acceptable and efficient professional care and hence medical officers must be military officers as well. Other plans have been tried, but this survives.

Thus it will be seen that of the hypothetical army, a million strong, the medical department has to assume the entire responsibility for at least 15 per cent, valid and invalid. This is no figment of the imagination, but a fact well known to every military student. Moreover, if a very large proportion of this 10 per cent of invalids return to duty, as they unquestionably will, they should return as soldiers, with the spirit of soldiers, which can be only if they remain in a military environment under medico-military officers specially trained to meet this demand.

Admitting these self-evident facts, and viewing them for a moment from a merely personal standpoint, surely the laborer is worthy of his hire and should be rewarded proportionately to his responsibility, efficiency, and fellows—a principle our countrymen have never disputed. The corollary of this is, the medical corps should be given a share in the higher grades of the army equal to 15 per cent of the allowance of such, since, as stated, it is wholly responsible for this number of troops; provided the allowance of general officers of the line is now as it should be, which we do not question. However, this is not a matter of personal advantage, but of service efficiency solely.

In the hearing before Congress it was asked "What would be done with all these medical general officers?" No question is more frequently asked or easier to answer, since it involves merely the number of military individuals to be supervised, no matter their location, occupation, or condition. A brigadier general is required for the supervision of approximately 5,000 men. A mere question of three or four general hospitals of 1,000 beds each, or such number of men in a medical training camp, or in the sanitary formations of an army in the field, or in the medical supplies department in which the work of 5,000 men is involved, etc. The whole thing resolves itself down to the number of men, nothing more or less, and upon this entirely defensable ground the medical department should base its claim for the means of efficiency.

Something was said of the opposition of the War College and General Staff to the proposed allowance of medical general officers. We do not believe that such opposition is actuated wholly by prejudice—though undoubtedly there may be individuals of narrow vision who are not able to look beyond the personal experiences of a two company post—but by a lack of knowledge of the tremendous responsibilities of the medical department in active service, especially in a war of the magnitude we have entered upon. But, they should not allow this lack of intimate knowledge of the workings of a great and vitally essential military department to place them in the attitude of contending that a specially trained man whom they call brigadier general is required to care for 5,000 soldiers under one military circumstance and not under another.

The hearing involved other phases, psychological, professional, social, financial, but all these, though important, are not essential and the question reduces itself simply to the efficient control of a given number of soldiers under given conditions, nothing more and nothing less. Herein lies the sole value of the proposed law to the country and the service.

WAR SURGERY: ACADEMIC AND REAL

A review of Borchard and Schmieden's "Lehrbuch der Kriegs—Chirurgie" (988 pp., Leipzig, 1917) in the *British Medical Journal,* January 26, p. 119, deserves the attention of our readers, as emphasizing the comparative worthlessness of texts on military surgery written from an academic viewpoint and far away from the front. The reviewer does not think much of war surgery, abstracted from books and magazine articles, by some one in the zone of the interior. The present volume, not accessible to American readers, is described

as a text-book, a thousand pages long, which says nothing of value to anyone preparing for work as a regimental surgeon on the firing line, and "smacks of Halle, not of the front." The fact that there is no reference to any prophylactic for gas gangrene suggests to the reviewer that "the censor has cut out all the epoch-making discoveries of Teuton surgeons, lest the enemy should profit," or else that "Teuton surgery has made no extraordinary contributions to the solution of problems common to them and to us."

There is nothing really whole-hearted about excision of the wound—nothing to match Sinclair-type methods for securing extension—instead, a final reliance on plaster of Paris. No Bipp, no flavine, no brilliant green, no chloramine, and the Carrel-Dakin method ill-understood and discredited. Does one look at the section of the jaws and the face, there are at least half a dozen men in the British service who could write a better account of better methods, and expose the whole of their personal results to put the matter to the test. The book is comprehensive, and as a storehouse of the past has a certain value until a French or British text-book appears.

Making every allowance for any slant of prejudice that may be attributed to antagonistic feeling, there is yet a deal of sound and substantial sense in the writer's argument. How can any up-to-date treatise on war surgery be worth the paper it is printed on, when not based upon actual experience at the front? The fundamental principles of military surgery, as with the surgery of civil life, remain immutable and the same; but, in the present war, at least, the data, the details, the improvements and the wrinkles are only derivable from stimulating contact with the wounded in the war zone. Written from any other angle, any book about the present war falls flat, is dead as a door nail as soon as written, and deserves speedy burial as soon as the joke of printing it is apprehended. It is an insult to the intelligence of any active minded medical officer to foist off upon him material written from the viewpoint of Halle or any other town in the "zone of the interior," away from the field of action. What has been learned by surgeons in the present war has been learned by attrition, by going up against the real thing, by trial and rejection of endless technical devices. A mere repository of dead knowledge, abstracted and cribbed from the brainwork and experience of other men, may be, as the writer says, a kind of historical curiosity, like the gigantic compendiums of the Arabian and mediaeval writers, but the success of the few really good books on military medicine of recent date, such as the French *Collection Horizon*, or the Oxford War Primers, is all the evidence we need that large-sized

compilations are absolutely useless to the regimental surgeon on the firing line, or the skilled operator in the base hospital. How can the active man in the field find time for multifarious reading, anyhow? It is his duty and his proper business to meet emergencies, and to devise expediencies. If he is to study, let him do his studying now, while time offers, and let him at least profit by the experiences of our allies, and not overload his brain with useless details. May our prospective writers on military medicine be wise in their generation, and not perpetrate the blunder stigmatized in this English critique.

BRAVERY—PHYSICAL AND MORAL

Doubtless every member of the Medical Reserve Corps, who has heard or read of the heroic conduct of British Medical Officers under fire, has asked himself the question: "Would I behave equally well under similar circumstances?"

No man can predict absolutely what will be his mental and physical poise in an emergency outside of his ordinary experience and training.

Physical bravery is largely a matter of heredity, of environment, or of temperament. It has been a common experience in this war that mental hebetude, or a lack of imagination, is a useful asset in time of danger, while a nervous, high-strung individual, with a vivid imagination and a dread of physical pain, is decidedly handicapped.

The fear of being afraid is always before the latter, until he finds himself in the thick of danger and knows that his fear was imaginary. Marshal Ney himself, "the bravest of the brave," said: "The man who says that he is never afraid is a liar," and this has been emphasized by many a veteran of the Civil War with whom I have talked. There is a wide difference between the reckless daring of a hot-blooded youth, oblivious to deadly peril in the heat of action, and the calm, deliberate exposure to the same danger on the part of a medical officer who had not the stimulus of the charge and, being a non-combatant, cannot return shot for shot.

To my mind, moral bravery is the highest type of all—the triumph of the spirit over the flesh.

"Tremble, thou vile body," Marshal Turenne used to say before a battle, "thou wouldst tremble more if thou knewest where I am going to take thee."

During a short sojourn as a patient in a military hospital it was my good fortune to make the acquaintance of a young English lieutenant, who represents to me the noblest courage of all. After nearly a year of agony he has begun to adjust himself to his new conditions and to plan how he can still make himself useful in

civil life. With his right arm and both legs amputated high up, he is always bright and smiling, with no self-pity, no regrets, only the calm consciousness that he has done his duty.

His story is by no means unique. While acting as a bombing instructor behind the lines, a bomb accidentally fell at his feet as he was surrounded by his class. Instantly he shielded them with his own body and now is only half a man, but a super-man in soul. The shy, gentle boy had moral bravery. The question which I asked at the outset has already been answered by many of our M. R. C. lieutenants. Not one of them has flinched in the face of danger. They all tell the same story of the spirit rising superior to the body. They feared the deadly rain of shells, but they walked into it to seek and to save. Let us who are yet to face the ordeal accustom ourselves to such mental training, such a preparation of the spirit, that when the time comes we may emulate these brave young doctors.

Having always been prone to introspection, I have sought each occasion when sudden risks were encountered to analyze my sensations, in order to discover what the predominating one was. In every instance it seemed to be not so much physical fear, as a curious feeling of expectation as to what would happen next. To tell the truth, the feelings excited by a bombing raid, whether behind the front, or in London, have always been anger and annoyance at the Boche. A submarine excites the same sensation, especially when one faces the prospect of a cold night ride in an open boat, with all one's good clothes left behind in his cozy stateroom. Of course, every soldier is a fatalist, no matter how devout he may be, how strong his reliance on a Higher Power. He *must* be. If he stopped to analyze his mental state, or allowed a too active imagination full play, he would never "go over the top," or walk out into a shell-swept area to bring in the wounded.

All our old teaching about the medical officer taking cover under fire has been swept away in this war. He must face the music, as we shall do when the necessity arises.

H. C. Coe.

OBEDIENCE TO ORDERS

One of the hardest lessons which the junior officers of the Medical Reserve Corps (and their seniors too) must learn when they reach the war zone is absolute and unquestioning obedience to orders issued from headquarters. It has been too often the reprehensible custom with men who have recently joined the corps, if they were dissatisfied with their rank or assignment to duty, to write, or to go in person to the Surgeon General's Office and endeavor to obtain

some position which they think better suited to their talents or professional standing. It will be a shock to these gentlemen to find that when they receive an order here, whether from the front or from the line of communication, it admits of neither question nor change. Washington is entirely cut off except through official channels.

This may at first seem most distasteful to the citizen-soldier, but, after a short experience, he will see how important it is that there should be only one head. The individual, whatever may be his rank, is only a small cog in the intricate machinery of war. The sooner he learns his own comparative insignificance, the better for him, and the more useful he becomes to the whole.

This is the lesson which we learn over here, and it is invaluable. Is is the essence of discipline, and when a man has once caught the spirit it never leaves him. We shall be better doctors and better men, those of us who return after the war, just because we have learned to be good soldiers and to submit our own wills to those of our commanding officers. Whatever our age or former position in civil life may have been, however superior we may feel ourselves to those of higher rank, socially or intellectually, it is not for us to argue or to question, but to *obey*.

H. C. Coe.

THE OBLIGATION TO THE UNIFORM

Every man who wears the uniform of the Army of the United States has a distinct obligation to the cloth itself, irrespective of the obligation to the country, whose livery the uniform is.

This obligation is so elementary that it would seem puerile to mention it were it not that there are too many of us wearing the uniform who have a very hazy idea of what we owe it.

Primarily one should know exactly what the uniform is in every detail, and be able to recognize it and the grade of the individual wearing it, at a glance. He should see that his own uniform is exactly in accord with the regulations, that it fits him, and always presents a neat appearance. Moreover, he should wear it as though it belonged to him and he should partake of the soldierly attributes of his clothes in as great a measure as possible.

The Medical Department, as usual, was the first of the staff departments to appreciate the necessity of training its raw levies, and the first to organize its training camps with a view, among other things, to giving the medical man some idea of the duties of the medical officer. Surely these have been worth all the time, effort, and money spent in conducting them.

Unfortunately not all of our new officers could receive this training and, as a result, there are not a few of us who are lacking in a knowledge even of our obligation to the uniform. This is a distinct handicap to the officer, personally and officially, for he has been deprived of his right to know something of his uniform, what it stands for and how to wear it. To overcome this handicap, we are glad to learn that some of the staff corps have started an elementary military course for their members, stationed in Washington, and probably elsewhere, who have had no previous military instruction, and that "customs of the service" cut something of a figure therein.

Leaving out of consideration the advantage which would follow a course in military manners, the sanitary advantages of some military training should appeal very strongly to the medical officer, who, chained to an unaccustomed desk, is devoting his daily, and may of his nightly hours, to the elucidation of unfamiliar problems, under unusual conditions.

In the interests of the health of these new, but valuable, members of the Medical Corps and distinctly in the interest of the service, we understand they are being formally turned out alternate days for an hour's physical exercise, which follows the lines of "the school of the soldier" in drill regulations for sanitary troops. "The position of the soldier," even though it does not wholly appeal to our orthopedists, has something attractive about it and is of long descent. "Facings," "salute with the hand," "setting-up exercises," "steps and marchings," should lend pleasing variety to the outing and clear the economy of ill humors which might reflect themselves in the solutions of the problems above referred to.

Then, for the ambitious ones, progress undoubtedly will be made into the "school of the detachment," the first stage of the team; formation of the detachment, "posts of officers and noncommissioned officers," "alignments," "to take intervals and to assemble." After these come marching in unison, to oblique, change direction, form column from line and vice versa, "movements by platoons, etc. All such have interesting possibilities. Finally, to crown the effort, some even might launch themselves into the intricacies of "litter drill"; but why dilate further?

The picture may have its funny side to the staid and dignified civilian in uniform, but who might easily be put to the blush, while in uniform, in the presence of those who know the obligation to the uniform. Our proposition is wholly serious. The obligation to the cloth should be met and this is a good healthy way to begin to meet it.

COMMENT AND CRITICISM

PRACTICAL FOOD CONSERVATION

Referring to Major Dye's very informing paper on this subject published in THE MILITARY SURGEON for April, page 465. the following extract from a report of a nutritional survey at Camp ——,[1] including base hospital No. —, points a moral which should appeal to all unit commanders.

The results of the survey are interesting not only from the standpoint of actual saving of food, but perhaps even more so from the fact that they indicate that your hospital regulations regarding the unnecessary wastage of food are effective. The average daily edible waste per man, in your mess was 0.21 lb. Our party has made similar studies in thirty-two army messes and in these the daily edible waste per man has ranged from 0.15 to 2.25 lbs., with an average of 0.82 lb., only one mess of the thirty-two showing a lower waste than your own. It must be understood that these waste figures also include coffee and tea to which sugar and milk have been added, and a considerable part of your waste was due to this source.

For your information I append a summary of our results on the edible waste in the thirty-two messes:

2 showed under 0.25 lb. per man per day.
6 showed from 0.26 to 0.50 lb. per man per day.
10 showed from 0.51 to 0.75 lb. per man per day.
5 showed from 0.76 to 1.00 lb. per man per day.
5 showed from 1.01 to 1.50 lbs. per man per day.
4 showed over 1.50 lbs. per man per day.

If we consider the above wastes from the standpoint of their content of protein, fat and carbohydrates, that is, the actual loss of nutriment, your mess shows by far the least waste of food ingredients found in any of our seven-day tests, namely 1.9 grams protein, 2.5 grams fat, and 9.1 grams of carbohydrates per man per day.

I have referred to the fact that you maintained during the week a varied menu. We found it also to be an adequate and well-balanced one. It yielded 3,618 calories per day, which would appear adequate for the needs of the men. Of these calories 13.7 per cent were derived from protein, 29.6 per cent from fat and 56.7 per cent from carbohydrates, showing that the balance was satisfactory.

The results of our tests have been most interesting to me and I congratulate you on the quite remarkable showing of your mess. On December 31, 1917, in a report to the head of our division, I used the following words:

"You will note from the above that in our experimental messes we have included one at the base hospital. This was done at the special

[1]Base Hospital No. —, Camp — is the institution regarding which Major Dye wrote.

request of Major Scott and Major Dye and in my judgment seems well worth while. This hospital affords the only evidence I have seen at any camp of any body of men really interested in food conservation in a practical way. I enclose memorandum prepared by Major Dye on this subject. In my judgment this is the most useful work we have encountered in our camp experience and is well worthy of emulation. I recommend that Major Dye's memorandum be brought directly to the attention of the Surgeon General with the idea that the methods used here might possibly be made a general order for all base hospitals."

The completion of our study of your mess justifies the opinion expressed and emphasizes the soundness of the recommendations I then made.

As frequently remarked by THE MILITARY SURGEON, no work is more important than the intelligent supervision of the messing of soldiers and it might seem, from the above quoted report, that such supervision is woefully lacking. In the examinations held to determine the efficiency of unit commanders, mess management should be one of the chief subjects and failure to pass it a first cause for discharge. We quite agree with Major Dye's summary of his plan of campaign for food efficiency and conservation.

(1) Propaganda, lectures and signs. (2) Foods to be saved and substitutes to be used. (3) Arrangement of menus. Study of caloric values. Balanced rations. (4) Cooks to be trained in preparation and saving of food. (5) Soap to be made from greases saved and lye from wood ashes. (6) Bone-black. (7) Utilization of unavoidable waste, food for chickens and laboratory animals. (8) *Inspections—Every meal—Every day—Every mess.*—EDITOR.

VENEREAL PROPHYLAXIS AGAIN

In the "Fit to Fight" photo play, literally a very moving exposition of the army anti-venereal campaign, the Mitchnekoffian prophylaxis is depicted, but no illustration of the condom and its use is shown. This time-honored preventive of conception and infection is perhaps a rather too deliberate defense to be accepted by our polite soldiers and, by the way, this is one of the handicaps to any form of prophylaxis—the disinclination of the man to permit the woman to think that he regards her as anything but desirable in all respects. We recall, in the beginning of the antivenereal campaign, that a prophylactic packet in cigar form was issued. These were generously bestowed by their patrons, the soldiers, upon the denizens of *les petites maisons,* who conspicuously displayed them as parlor ornaments and derisively invited their partners to "have a cigar." The resentment and ridicule of the prostitute and the credulity of her paramour are distinct factors of failure in venereal personal pro-

phylaxis and this resentment and ridicule are encouraged by the promoters of this traffic, who realize that when their patrons are brought to appreciate its danger, as evidenced by the necessity always to guard against it, the wiser ones will avoid it altogether and the ordinarily foolish will be influenced to follow their example.

P. A. Surg. Louis Schwartz, U. S. P. H. S., has sent us the following comment.—Editor.

It is with fear of severe criticism that I approach this much discussed and delicate subject; but the great desire to make our fighting forces as effective as possible has urged me to write this paper. It is recognized by most medical men that no amount of education or talking can prevent clandestine intercourse. The reasons for this are evident. Nature has given us, in common with other animals, a strong desire for sexual intercourse in order to perpetuate the race. This desire, usually stronger in the male, manifests itself about the age of puberty. According to present standards of living this age is too early to marry. The result is that in many the desire finds its outlet in clandestine intercourse, either with prostitutes or sweethearts. For various other reasons, economic, physical, etc., some men of marriageable age do not marry. There are many of these who will not or cannot suppress their sexual desires and gratify them in the same manner. These are bare facts and have been operating amongst civilized people for many thousand years, spreading venereal disease throughout the civilized world and amongst the uncivilized where civilized man has visited.

Soldiers and sailors are particularly exposed to venereal disease and are strong factors in its spread.

Women have from time immemorial been especially attracted to the warrior. This has been because we all admire a fighter and because in the fighting man are exemplified all the manly characteristics which by nature have been made attractive to the female.

The uniform, the sign of the warrior, seems not to have lost its power to attract the female of the present generation and, as a result, the soldier and sailor are exposed to great temptation and the Sir Galahads that can resist are rare indeed.

There has been in all wars a considerable portion of the fighting forces incapacitated by venereal disease, and the present war is no exception.

To combat this, many methods of venereal prophylaxis have been tried and have met with varying degrees of success. The prophylactic kit, composed of 5 per cent calomel ointment and 20 per cent solution of argyrol, with directions for use immediately after intercourse, gave good results, but it often was not properly applied because of ignorance, or not used at all because of embarrassment in the presence of the female. The preventive treatment given by trained attendants,

upon return from leave, was often done too late to avert infection, and often the men did not report for it.

We had long had at our means a method for the prevention of venereal disease which is far better than any so far systematically tried. It has been secretly asked for and secretly sold by druggists and others at exorbitant prices to people known to them and seemingly as a favor. It is deemed a culpable act to buy one, and it is with a feeling akin to guilt that it is sneakingly purchased in an obscure corner of the store.

I speak of the condom, the free distribution of which, together with the teaching of its proper use to our soldiers and sailors, would at one stroke not only wipe out venereal disease from the military forces, but would prevent its spread amongst the civil population. It will prevent "war babies" which are not a desirable kind. It will save many a good girl from the consequences of one indiscreet act at an unguarded moment. It will prevent the returned soldier from bringing back to his family and his country, and transmitting to future generations, the germs of venereal disease.

There will be many objections against this clean, sanitary, and obvious method of venereal prophylaxis. The most important of these will be: First, that by putting into the hands of our men a means to gratify their sexual desires without fear of the consequences, they will indulge them more freely. Second, that by the free distribution of condoms to our military forces, we sanction vice and lower our morals. Third, that we put a means of birth control into the hands of our men and thus promote "race suicide." Fourth, that by removing the fear of pregnancy, women will the more readily give way to sexual desires and thus increase vice.

The answer to the first is that the fear of infection rarely prevents the gratification of sexual desire. It is only after the act is completed and the desire satisfied that the young man gives any thought to the consequences. To the second objection we say that by the distribution of condoms we recognize that illicit intercourse exists and that it spreads venereal disease, but we do not sanction it. We simply aim to prevent its harming our fighting efficiency. Let us not shut our eyes against the truth, just because the truth is not nice to see. Let us recognize the truth and try to save our boys from themselves. To the third we say that illegitimate births are not desirable. Most married people already know the use of the condom, yet very few use it in lawful coition.

To the fourth, if only fear of becoming pregnant is keeping a girl from illicit intercourse, she soon finds a way to prevent conception or bring about abortion. The professional abortionist is thriving in every large city. On the other hand, many an unsophisticated girl has become a prostitute because she was forced to leave her home as she could not face the disgrace of an illegitimate pregnancy.

As to the method of distribution of the condom to our military

forces, the condoms could be distributed to the medical officers of each regiment or military unit, to the medical officer of each war vessel and to the commanding officer of naval vessels carrying no physician. It would be freely given to each man going on furlough or ashore, with orders to use if occasion should arise,and to report to appropriate officer on return to duty whether there was occasion to use it and whether it was used. As each man is supplied with the condom he is instructed how to use it to prevent tearing, and how to clean it after use.

TO PROMOTE SANITARY EFFICIENCY

Maj. Henry L. Stickney, M. R. C., has introduced a scheme, long in use in our summer camps, of grading the sanitary condition of the several companies of the regiment to which he is attached and conspicuously posting the result of his inspections. This worked very well in the maneuver camps which were attended a few days for instruction, not to mention amusement, but we had not thought of it in camps of an army mobilized for war, in which there should be but one standard, the highest to be attained by strict military discipline and training, not by grade school methods.

Major Stickney's practice of systematically noting the results of his inspections and reporting them to the regimental commander is good, as thereby he makes a continuing record which should enable the authorities to determine the efficiency of the company commanders. These officers are the sanitary executives of an army and their fundamental duty is to maintain the interior economy of their companies at the highest standard. If they fail to do this they should be discharged, and the posting of anything but a white card should be the occasion of a court-martial for neglect of duty.—Editor.

An equitable and systematic grading of the sanitary conditions of a regiment has not been adopted generally by the Medical Department so far as I have been able to learn.

The routine and haphazard methods of daily inspecting the barber shops, exchanges, mess halls, kitchens and latrines have been far from satisfactory. A perfunctory inspection is usually and generally made, complaints registered and recommendations made which, from the standpoint of efficiency, are far from satisfactory, but have been accepted by the commandant and the division inspector as the only solution at present available.

The regimental inspector himself did not get the results he sought; the commandant, company commander and mess sergeant were all "at sea," so to speak, as to just what was wanted by the inspector. The result was that we arrived at the same place from which we started, "a vicious circle" as it were.

A month or so ago the writer evolved a system of grading which met with the approval of the division surgeon and regimental com-

mander and, after having tried out this method in the regiment thoroughly for a month, he is pleased to report that it is with the greatest degree of satisfaction that he fully intends to continue the use of it. The writer is going to pass it along to the readers of THE MILITARY SURGEON with the hope that it may be tried out by other regimental surgeons.

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First it encourages a spirit of good natured rivalry among the different company commanders and mess sergeants to outdo the other. An *esprit de corps* has been fostered by this method of card grading which has been most gratifying. A standard of judging the defects and improvements is given the inspector in making his reports. A standard to be reached by the company commander and mess sergeant is always before them and their departure from it, noted and *pro rata* according to the unit ratio, is noted and left with them for their study and profit.

If a percentage of 85 or higher is attained in the aggregate, the company is given a white card, marked A; if between 75 and 85 a blue card or grade B, and if below 70 a red card or grade C is posted. These cards are tacked on the outside of the building by the inspector, together with the graded rating slip, and are not removed by anyone except the inspector. Separate and classified ratings and cards are used for mess halls, kitchens, latrines, barber shops and exchanges.

A report of these grades are made daily to the commandant, who reads it aloud at officers call.

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CURRENT LITERATURE

The Bread Card, Its Utility and Fixation, by E. Maurel, National Correspondent. *Bull. de l'Académie de Médecine,* 16 October, 1917, No. 40, p. 419.

Recent events in food economics and food traffic seem to indicate that the balance between supply and demand for the different food-substances of a given people, the economic coefficient, so to say, is as characteristic for any particular country as are the habits and temperaments of the peoples themselves. Thus, for example, while England, notwithstanding her vast colonial possessions, appears to be somewhat short of most all the principal food articles, as wheat, corn, beef, pork products, dairy products and sugar, those articles from which about 86.7 per cent of the total energy of a diet is derived, our other ally, France, likewise possessed of extensive over-sea colonies, seems to be more especially concerned in the threatened lack of supply of wheat and bread, at least at the time when Maurel wrote his essay.

Maurel draws a rather gloomy picture of the condition of the wheat reserves of France, saying: "We have planted (using official figures) 4,207,830 hectares, when we ought to have planted 6,539,540 h. and which represent the mean for the last ten years preceding the war. On the basis of the mean return rate, for the same ten years, which is 13.52 hundredweight per hectare, I had counted upon a harvest of 56,885,805 hw. Contrary to these expectations, the actual production does not exceed 39 millions and may even turn out to be as low as 35 millions, thus lowering the return rate down to 9.26 or even 8.31 hw. per hectare, while the very lowest figure, reached during the last ten years before the war, was 10.50. Such a result could only be explained, besides, by the poor quality of the land, by a culpable lack of the proper care and the failure of supplying the land with the needed manure." He then calculates that "if we cannot count upon substitutes from our colonies, upon rye and buckwheat, it will become necessary for us to import from abroad 35 millions hws. of wheat this year, or between now and our next harvest, or 8 millions more than last year, and, even if we should be able to import this amount, our people would still be obliged to observe the strictest economy with their wheat and its chief product—bread." He insists upon the necessity of the introduction of the bread card as one of the most important measures against the habits of wastefulness of both flour and bread.

There are, according to Maurel, two considerations tending to make the introduction of a bread card in France an easy matter, one being the absolutely uniform composition of their bread—one kind of bread for everybody—and the other is the custom of the French people of buying the bread from a baker.

For people living in restaurants, boarding houses or hotels, he recommends that the managers of such institutions be furnished with individual cards. "Pensionnaires" are to receive the same portions as the members of a family, namely, 100 grams for the first déjeuner and 200 grams for the other two. For

the daily average quantity to be supplied, taking account of a population of all ages, Maurel allows 350 grams for which amount the accounts are to be kept at the bakery. An additional quantity of 100 to 200 grams is to be allowed a man doing hard manual labor in the open air; for the rest 400 grams are deemed amply sufficient.

Estimating the population, including refugees and workmen from the colonies, as amounting in round numbers to 40 millions of all ages, and, after making due allowance for children and old people, needing less than the full adult ration, he finds the total requirements for the mixed population to be equal to the needs of 32 millions of adults. Allowing 500 grams of bread per ration, the *daily* consumption would remain within the limits of 16 million hws. of bread, the *annual* requirements within 58,400,000 hws. Since 100 grams of flour furnish about 130 grams of bread, 44,923,000 hws. would produce 58,400,000 and since, moreover, we will have to reckon with a loss of 18 per cent in the process of milling, 54,784,400 hws. of it are needed for the production of the desired quantity of flour. With such an amount of flour, 58 million hws. of bread can be produced, a quantity sufficient for the maintenance of a population equivalent to 32 millions of adults, representing a mixed population of 40 millions of all ages, and to enable us to furnish each one of the 32 millions of adults 500 grams of bread.

Maurel sums up the present conditions, in France, as being about as follows: If 55 million hws. of wheat for bread-making purposes could be set aside, as available, the quantity of bread needed would be assured. But 10 million hws. of it will have to be reserved for seedlings and about 5 millions for alimentary pastries. In totalling these three items, the sum of 70 millions of wheat is obtained as the amount required. The harvest having supplied but 35 millions, the resulting deficit is 35 millions. Therefore, and even granting that France can depend upon the production of her rye and buckwheat, amounting to 10 millions, and upon the importation from the colonies of 5 millions of flour, she could not get along without an importation from foreign parts of less than 20 million hws. of wheat to cover her actual needs.

After adding a series of timely and important recommendations, intended for the prevention of wastage, Maurel sums up with the following conclusions: (1) Our harvest in wheat amounts to 35 million hws. and our requirements to 75 million hws. (2) Taking in even 10 million hws. of rye and buckwheat, we would still be obliged to import 25 million hws. of wheat. (3) We are, therefore, forced to economize and, to this end, to introduce the bread card as the most efficacious means for the prevention of waste. (4) This card to have, as a basis, 400 grams per person and a supplementary allowance of 100 to 200 grams for men engaged in hard outdoor work. (5) The introduction of such a card will guarantee the satisfying of the needs, with a supply of 70 million hws. of wheat, of a population represented by 32 million of adults.

H. G. Beyer.

"Every war-wound, not containing streptococci, must be sutured." A lecture by Dr. Georges Gross, Médecin-Chef de l'Ambulance, chirurgicale automobile No. 12. *Bull. de l'Académie de Médecine*, No. 41, 1917, Séance 23, October, p. 466.

After an experience of several years with large incisions, then with excisions, surgeons at the front began to notice that certain wounds healed in so simple and natural a manner that the idea of primary suture suggested itself to them. The author claims to have been the first to practice complete closure of war wounds in the surgical automobile hospital No. 12, with varying success, but confesses that he did so without being able to base his observations on any scientific facts or to explain to himself why certain wounds cicatrized by first intention, while others, operated on under identical conditions, did not do so until about three months ago. The studies of Tissier (*Recherches sur la lore bacterienne des plaies de guerre*) furnished the desired information.

Tissier's conclusions were that it was the anaerobes which determined the putrid infection of war wounds, but that their development depended (1) on the presence in the wound of dead tissue and (2) on the simultaneous presence of one or more aerobes. The extension of the gangrenous process depends on the presence of the anaerobes and the aerobes associated with them. In the serious infections, this acrobe, always, is the streptococcus.

The practical conclusion is: That every war wound, not infected by the streptococcus, may be united by suture, after proper surgical treatment, and ought to heal. If the bacteriological examination reveals the presence of streptococci, the sutured wound should be reopened; in every other case in which complete excision was done, it should be left alone after the patients have arrived at the hospital. The streptococcus, cultivated on a liquid medium, at 37°, will give the answer in 5 to 6 hours.

Of the 759 sutures, done by Tissier's method, between July 23 and September 10, 50 days, 675 healed by first intention, 47 healed partially and 37 were reopened after the presence of streptococcus had been shown. The successes, therefore, amounted to 88.8 per cent.

Dr. Gross concludes that primary suture constitutes the rational treatment of war wounds; that the great merit of Tissier consists in his having shown that the quality of the infecting microbe alone is of importance; that the presence of the streptococcus alone should prevent the closure of a wound or cause its being reopened. This streptococcus is met with in from 10 to 15 per cent of war wounds of recent date; all the others should be closed.

A successful suture must be preceded not merely by a process of superficial cleaning but by large excisions.

As pertinent to the important question of the early closure of war wounds, discussed in the above paper and, perhaps also, as illustrating how long it sometimes takes for an idea to develop to a point of practical application, the reviewer may be permitted to add a few passages from a paper he read at the fourth annual meeting of the Association of Military Surgeons of the U. S., at Washington, in 1894.[1] In this paper he cited the fact that Langenbuch,[2] from his

[1] On First Aid on the Battlefield, by Surgeon Henry G. Beyer, U. S. N., Proc. Assoc. Mil. Surgeons, Wash., Fourth Annual Meeting, 1894, iv, pp. 351-361.
[2] Langenbuch, *Deut. Med. Wochenschr*, 1894, No. 12.

experience in the war of 1870-71 and from experiments made since that time, come to the conclusion that gunshot wounds were not always primarily septic in nature and that one of the prime objects was rather the prevention of secondary infection; he, accordingly, recommended in 1892, at the Congress of German Surgeons in Berlin, that the simpler wounds be hermetically sealed, right on the battlefield, at least temporarily, either by rubber plaster or temporary suture. The same principle was later applied in practice by Wagner in the Servio-Bulgarian campaign. We know, furthermore, that the organism, in some way, can take care of a certain class of bacteria, provided they are not of a septic or pyogenic kind, in large quantities. Pfuhl buried pieces of soldiers' clothing that had been exposed to perspiration and street dust, under the skin, into muscular tissue, into the pleural and peritoneal cavities of both mice and rabbits, without getting a single case of wound infection, except when these pieces of clothing were infected with stophylococci or streptococci. Similar experiments with identical results were made by Fraenkel of Vienna in 1888. "There is many a slip twixt cup and lip."

H. G. Beyer.

The Problems Regarding Carriers of Amebic Dysentery in India and Mesopotamia, by W. MacAdam and R. Keelan. *Indian Journal of Medical Research,* July, 1917, p. 240. (From Bull. Mens., Office Intern. d'Hygiène Publ., Tome ix, No. 11, November, 1917, p. 1436.)

The report of the authors is based upon the examinations of more than 2,000 subjects belonging mostly to troops in Mesopotamia and is of special interest concerning the question of the frequency and the persistence of the infections due to *E. histolytica.*

Infections have been numerous among the troops in Mesopotamia. Among a number of 351 "non-dysenteric" subjects, examined in a general hospital, 13.6 per cent, and in 595 men in a convalescent depot, 17.8 per cent, were found to be carriers of cysts. It is assumed that no less than 33 per cent carriers of *E. histolytica* are present among the men having served in Mesopotamia. Later, the proportion of infections with *E. histolytica* was found to be greater among the "non-dysenteric" sick of the hospitals and depots of convalescents than among those specially admitted to the hospital as carriers of dysenteric amebae.

In general, emetine treatment remained problematical; while improveing symptoms, it failed in sterilizing the carriers of cysts. As long as we are not in possession of a method for obtaining complete sterilization, the prevention of amebic dysentery, according to the authors, will remain solely a problem of the epidemiologist and of general sanitary measures. The method of trying to eliminate carriers by the repeated examination of the excreta is pronounced impracticable, the authors having found, in a series of carriers leaving the hospital, after five negative examinations of stools, the persistence of the amebic infection in 50 per cent of the cases. It is certain that "healthy" troops include among their number a large proportion of cyst-carriers that are un-

suspected. From among such the authors found that 17 per cent presented no intestinal symptoms at all, and 47 per cent did not consider themselves sick enough to come on the list.

Consequently, the authors doubt the utility of pursuing the isolation and the treatment of convalescents, as well as of the established carriers, once a clinical cure having been accomplished, up to the time of their being considered as sterilized. The authors do not believe that the results obtained pay for the trouble and the expense incurred; they point out the fact that Wenyon and O'Connor, in their report on the infections due to protozoa in Egypt, had arrived at identical conclusions.

H. G. Beyer.

Avitaminoses, by Hullshoff Pol. *Nederlandsch Tijdschrift voor Genees Kunde*, 6 October, 1917, p. 1212. (From Bull. Mens., Office Intern. d'Hygiene Publ., Tome ix, No. 11, November, 1917, p. 1494.)

The term "avitaminosis" has been given to that group of diseases originating in an alimentary insufficiency of certain, as yet imperfectly known, substances; whether the deficiency by itself alone gives rise to the symptoms or whether it merely favors an intoxication is immaterial. Beri-beri, scurvy, Barlow's disease and pellagra are deficiency diseases or *avitaminoses*.

The author insists that these are distinct diseases, each one resulting from the absence of a special kind of vitamine in a given diet. Thus, for instance, beri-beri does not improve by the addition to the habitual diet of a large portion of fresh vegetables, while scurvy is recovered from by a very slight addition of these. The polyneuritis of chickens is arrested by the administration of the Java pea, but not while it germinates; on the other hand, the administration of the Java pea provokes scurvy unless germinating peas were given. It would seem, therefore, that there are several varieties of vitamines necessary to a perfect diet and that the deficiency of one produces a definite set of symptoms.

The same is true for Barlow's disease. It might be supposed that the "thermolabile" antiscorbutic substances of milk which are destroyed on prolonged boiling, and then produce the disease, were the same as those the absence of which causes polyneuritis; but the latter resist a temperature of 100° and are thermostabile. The author, moreover, has found that the boiled Java pea cures beri-beri. As for pellagra, it is certain that corn (*zea mais*) is deficient in vitamines. Urbeanu attributes the disease to a lack of potassium in the diet; Schaumann believes it to be due to a deficiency of phosphorus. These substances, whatever they may be, the absence of which produces these diseases, are different for the different diseases.

H. G. Beyer.

A New Parasite of the Eye of Man (*Loa extraocularis nov.* sp.), by K. I. Skrjabin. Comptes rendus des séances de la Société de Biologié, séance du 28 Juillet, 1917, p. 759. (From Office Intern. d'Hygiène Publ., Tome ix, No. 11, November, 1917, p. 1463.)

The new parasite was extracted from a new formation, located at the inner angle of the eye between the orbital wall and the ocular globe in a man from the northern Caucasus. When the tumor was opened, a rapidly moving worm was found. It was a female filaria, not completely mature and measuring 143 millimeters, zoologically, differing in diverse characters from *Loa Loa* Guyot, 1778; *Filaria conjunctivae* Addario, 1885; *Filaria lencis* Dies, 1851; and *Trichinella spiralis* Owen, 1835. Named, by the author, *Loa extraocularis* and described in detail, differing especially from the other species by the position of the vulva (very much further removed from the buccal orifice), the structure of the caudal extremity and the location of the nerve-ring (near the cephalic extremity). It is more nearly related to *Loa Stiles,* 1907, of which it would constitute the second species, while *Loa Loa* would remain the first typical species.

H. G. Beyer.

On an Epidemic of Bacillary Dysentery in the Region of the Somme, by G. Loygne and I. Haguenau. *La Presse medicale,* 23 Jouillet, 1917, p. 421. (From Bull. Mens., Office Intern. d'Hygiène Publ., Tome ix, No. 11, November, 1917, p. 1435.)

The observations of the authors include 449 cases of acute dysentery, most of them primary, between August 10 to November 10, 1916. The epidemic was of the pure bacillary type (rapidly increasing and decreasing, clinical characteristics well marked, favorable results of serotherapy, typical post-mortem lesions). Dysenteric amebae were found in nine cases only, of which six were relapses.

All of the facts observed during the course of this epidemic are calculated to restore to the bacillus of Shiga the importance which it was in danger of losing, through the enumeration of new types of para dysenteric bacilli, as those of the group of "Flexner-His." Without a doubt the latter have had a share in the constitution of the syndromes of dysentery or of a similar disease, but the bacillus of Shiga (Kruse?) has shown itself to be the true causal agent of the epidemic.

The authors base their conclusions on (1) the identification of isolated germs; (2) sero-diagnostic; this test, in dysentery, has a value quite comparable to that which the sero-diagnostic has in typhoid fever before the introduction of vaccinations.

There was, besides, a very distinct relation existing between the clinical gravity of the cases and the results of the bacteriological examinations. The frequency of serious cases and the mortality rate were in perfect agreement with the predominance of the bacillus of Shiga and sometimes with the existence of an "association typho-dysenterique."

H. G. Beyer.

On Antiseptics, Regular and Irregular, by Charles Richet, in collaboration with Henry Cardot. *Bull. de l'Académie de Médicine,* Séance du 16, October, No. 40, 1917, p. 425.

Antiseptics are classified in accordance with a novel principle; a method with which one of the authors has worked for more than ten years and by the use of which it is hoped to determine in the future the value of an antiseptic experimentally, an object, the obtainment of which seems to us of fundamental importance.

I. The same fermentable fluid, put into a series of flasks, subjected to the same temperature and allowed to ferment for an identical length of time, will, notwithstanding the identity of all these experimental conditions, show marked differences as regards the intensity of the process of fermentation going on inside of them.

Calculating the mean, each one of the fermenting flasks will show a certain deviation from it; taking the mean of these deviations, the "*mean*" of the "*means*" is obtained.

For example, when milk is allowed to undergo fermentation, excited by a very pure ferment, the amount of acidity produced, while similar, will nevertheless be slightly different in each one of the flasks (as determined by its neutralization with a standard solution of potassium hydroxide).

Thus, in one fermentation, it was found, in cubic centimeters of potassium hydroxide solution:10 cc., 1; 10 cc., 2; 10 cc., 8; 9 cc., 5; 9 cc., 2; 10 cc., 1.

Let the six dosages of sera equal 10, the mean deviations will be: 0.1 cc., 0.2 cc., 0.8 cc., 0.5 cc., 0.2 cc., 0.1 cc., which is to say 2.5 cc. for the six flasks or 0.41 for each. The value 0.41 represents the mean of the means. Therefore, if 10 cc. give a mean deviation from the acid unit of 0.41, 1 cc. has a relative deviation of 0.041.

II. This being granted, in taking the relative mean deviation of a large number of fermentations (12,000) it was found to be equal to about 0.06. It now became possible to employ this number as a starting point in the determination of the mean deviations of fermenting fluids in the presence of antiseptics.

Leaving out of consideration, even, the volatile and easily decomposed antiseptics, there remains still a large class of them in which, through a determination of the deviation from the mean, the regularity or irregularity could be obtained.

It was found to be the general, almost absolute rule that fermentable fluids, in the presence of any foreign substance, whether antiseptic or not, always fermented less regularly, the nearer the dose approached the toxic limit, than when the liquid was normal. But, even in this irregularity, different degrees were noted.

The salts of mercury, for instance, showed a most unexpected and quite improbable irregularity. Taking as a limit that dose which diminishes by 50 per cent in twenty-four hours, the activity of a fermentation, it was found that certain flasks had not fermented at all, while others exhibited an activity equal to, sometimes even greater than, the control flasks. Let the mean deviation of the controls equal 100, the mean deviation with the salts of mercury will equal

600. Silver salts, zinc and cadmium salt behave in a similar manner. These constitute the *most irregular* class.

The *second group* comprises those belonging to the *irregular* antiseptics, and in which the mean deviation moves between 250 and 500, taking that of the controls as 100. Phenol and copper sulphate belong into this group.

The *third group* constitutes the group of *regular* antiseptics, including creosote, thallium nitrate, magnesium chloride, lead nitrate. With these, the mean deviation varies from 100 to 250.

Finally, and entirely apart from the above mentioned substances, stands sodium fluoride, for which, as a most remarkable exception, a regularity was found to exist greater than that present in the controls, that is of 90, assuming that of the latter to be 100.

When it is remembered that sodium fluoride (*fluorure de sodium*) is, relatively, but slightly toxic, that it is antiseptic at a dose from 2 to 3 grams per liter, that its price is moderate, that it is non-injurious to the cells, it certainly possesses all the desirable attributes as to recommend it to the surgeons as well worthy of being tried out clinically for its possible antiseptic properties.

III. Our authors, basing themselves on these grounds, demand that, henceforth, in the determinations of the values of an antiseptic, its regularity or irregularity be taken into account. As *regular* are considered those antiseptics that show about or nearly the same behavior in all the samples of a fermentable liquid; as *irregular* those that show large deviations in their aggressive action against microbes and of which, in consequence, it is impossible to tell beforehand, with any degree of certainty, what their effects are likely to be.

H. G. Beyer.

The Struggle against Tuberculosis in the Army. *Giornale di Medicina Militare,* Anno lxv, October 31, Fasc. x, 1917.

Almost the entire number of this journal is devoted to this most important question. The most experienced specialists have contributed their respective shares from most every angle of vision. Scientific laboratory workers and practical clinicians have focussed their attention on the subject. The Italian government seems to have been aroused to the necessity of paying adequate tribute toward the solution of the problem, by making it one of the principal tasks of the health office, recently organized under the war department, to eliminate, if possible, all tuberculous subjects from the army in the field.

It appears that in Italy, no less than in other countries, many recruits, after a necessarily hurried examination, pass the recruiting officers without being detected as tuberculous subjects, the disease being in a latent stage. Under the stress of active military duties, latent or inactive cases of tuberculosis are converted into open and active cases, the soldiers thus affected becoming a danger to themselves, their comrades, impairing the efficiency of the army; their elimination becomes an imperative necessity.

Since it is next to impossible for any medical recruiting officer to make a diagnosis of all latent cases of the disease in the short time and with the limited means at his command, even supposing him to be an expert at the business,

the government has wisely concluded to establish certain special centers or hospitals in connection with every army corps, separate and distinct from general hospitals, and, possibly, in country districts, but equipped with all the special means, including roentgenological apparatuses, for clinching the diagnosis within the bounds of scientific possibility; then eliminating or segregating all such patients for further observation and treatment.

While, of course, this movement is chiefly directed against the damage likely to arise from tuberculosis, to the efficiency of the army; while it includes the benefits of the individuals affected and is calculated for the protection of the healthy soldiers, it seems, also and perhaps, incidentally, to involve the clearing up of that most ticklish line-of-duty question, with the existence of which and the responsibility for deciding which, every military and naval surgeon has been made painfully aware from experience, be that ever so limited.

With special reference to the subject of tuberculosis, medical officers in Italy, as in other military countries, appear to be divided into two camps. While the members of one camp express the decided opinion that every case of tuberculosis, occurring in a soldier on active service, after once passing the recruiting office, is to be considered as having occurred in the line of duty, obliging the government to take care of him, to pension him, if permanently invalided, those of the opposing camp are as decided in their expressions of opinion to the effect that, the disease existing prior to the soldier's entry into the service, the government ought not to be held responsible for the case, on account of its having existed prior to the man's entry into the service and must be considered as not having occurred in the line of duty.

Thus assuming, and, provided that it is not one of the duties of the government of a country to care aud be responsible for the support of every unfortunate sick subject in the realm, and further assuming that human sympathy and ties, on the one hand—however creditable under ordinary circumstances—and cool, unbiased judgment, on the other, mutually exclude one another, the stubborn facts of an accurate diagnosis of the disease ascertained at the time of man's entry into the military service, alone, ought to be made to prevail and decide the question of line of duty or not line of duty. In logical sequence to this view of the case and in order to establish the necessary facts, it has been made part of the duties of these special tuberculosis centers to include the settlement of this question; their detailed organizations and functions have been published in the form of ministerial decrees governing the service.

The contributors to this very interesting symposium, covering nearly every phase of the tuberculosis problem in its relation to the army, and, unfortunately, too vast for a brief abstract, are the following named, well-known authorities: Sforza, Maragliano, Ronzoni, Romanelli, Cantani, Signorelli, Fagluoli, Aessandrini.

H. G. Beyer.

The Clinical Estimation of Urinary Toxicity, by Billard and Perrin, Professors at the medical school of Clermont-Ferrare. *Bull. de l'Académie de Médicine*, No. 46, 1917; Séance du 27, November, p. 620.

The method for the determination of urinary toxicity, employed in France up to the present time, has consisted in the direct injection of the urine into the

marginal vein of the ear of the rabbit. Of normal urine, 50 cc. are generally required for the killing of 1 kg. of rabbit. According as it requires more or less of any urine for arriving at the same result, the urine is pronounced more or less toxic.

It was the authors' aim to devise a simpler method for use in the clinic. When they had discovered that the urinary toxins possessed the property of lowering the surface tension in a solution, they very naturally inferred the existence of a definite relationship between the surface tension and the toxicity of a urine and which, indeed, they were able to prove by physiological experiments.

Like the specific gravity and the freezing point, the surface tension of any liquid is a specific constant. Thus the surface tension of water, at 15° C., is 7.5 mg. In determining the Ts. of the urine, they made use of the drop-counter-pipette of Duclaux. Counting the number of drops in 5 cc. of urine, at a temperature of 15° C. (η) and, taking the specific gravity (d), they calculated as follows:

$$\text{Ts.} = \frac{100d \times 7.5}{\eta}$$

They found that the Ts. of urine varied between 4.70 mg. and 7.45 mg. for a temperature of 15°. Injecting a certain number of urines, coming from different patients, according to the method of Bouchard, having determined the Ts. at the same time, they obtained the following results:

Ts. of urines examined, mg.	*Toxic values*	*Ts. of urines examined, mg.*	*Toxic values*
5.76	13	6.60	48
5.88	17	6.88	53
6.02	20	7.09	81
6.15	27	7.13	88
6.22	34	7.25	96
6.34	40	7.41	164
6.49	45		

The authors, without claiming for these biological findings the accuracy of a physico-mathematical law do maintain it as a fact, that the quantity of a given toxic urine, necessary for killing 1 kg. of rabbit, is the smaller, the lower its surface tension. H. G. Beyer.

Trench Fever, or P.U.O., Associated with the Presence of a Hemogregarine, by Lyn Dimond, M.B., Ch.B., Manch., Captain R. A. M. C.; Bacteriologist, Military Hospital, Hampstead. *Lancet*, September 8, 1917, p. 382.

With the aid of an absolutely faultless technique, the author discovered the presence, in the circulating blood, in liver, spleen and lung punctures, of a small hemogregarine, resembling in many respects the *Hemogregarina gracilis* of Wenyon in a lizard host, *Mabuia quinquetaeniata*, in twelve cases of P.U.O., or trench fever.

The two more common types of the hemogregarine encountered in the venous blood a day or two before the onset of pyrexia are (1) macromerozoites, 7 to

13μ long, generally free in the plasma, and (2) micromerozoites, 3 to 4μ long, more commonly encysted, and in the red corpuscles, but may be free. In addition to the micromerozoites, not more than 1μ wide, there are other free or encysted "sausage-shaped" forms 4 to 6μ long by 3 to 4μ wide. Within their transparent cyst the blue-stained cytoplasm stands out clearly and the deep red-stained nucleus consists of small pyriform masses of chromatin, so arranged as to give it a rosette appearance. Other types of "sausage" bodies are encountered in the blood of these cases . . . whose round or oval nucleus consists of a thin red-stained circumference with a single deep red chromosome at its center . . . They gradually increase in number up to the height of fever, when they disappear, and, the day after the fever, none of these forms can be found, the only form of parasite then present in the blood being the parthenogenetic gametocyte. This gametocyte ultimately, just before the rise of temperature, gives rise to 20 merozoites (illustrated by diagrams). "Personally I have found spleen punctures the quickest way to establish the diagnosis of trench fever."

"In brief, this gametocyte of the hemogregarine of trench fever is a round, oval or bluntly triangular body in shape, which in the first stages of development is 4 to 6μ long by 3 to 5μ wide. The cytoplasm is stained an intense blue and is coarsely reticular in specimens stained by Giemsa's method. There is a large, diffuse, purple nucleus *de reliquat*, and at the periphery of the cell there is a dense, deep red stained nucleus rich in chromatin. This is usually situated at an opposite pole to the nucleus *de reliquat* . . . This nucleus gradually divides into two, then four, eight, until 20 nuclei are formed; sporulation commences with the setting free of 20 small merozoites. These merozoites at the moment of sporulation are generally 0.75 to 1.2μ long, and gradually become larger until the mid-stages of pyrexia, when they disappear from the venous blood. In distinction from the gametocyte of latent malaria (*H. vivae* infection) this gametocyte of trench fever possesses no pigment or hemozoin."

"The fact that this protozoon is a hemogregarine suggests the extreme probability that the *Pediculus corporis* or a louse allied to the *Hematopinus stephensi*, parasitic on the Indian field rat, is the carrier of the protozoon. The presence of such a large number of rats in the trenches seems to favor this conclusion. H. G. Beyer.

The New Dietetic Treatment of Diabetis, by P. J. Cammidge, M. D., London. The *Lancet*, October 6, 1917, p. 522.

The reviewer, interested in his readers and desirous that they should reap the fruits of the labor of some of the fittest workers in the vineyards of the profession, within the shortest possible space and time and with the least possible expenditure of their own energies, sometimes finds himself in a serious dilemma. On the one hand, he is fully convinced of the fact that no medical practitioner could well afford to miss the valuable lessons conveyed by a certain paper; on the other, he finds that, in order to attain this desirable object, the article, being already written without the use of a single superfluous word, ought to be read and even studied in its entirety and without further mutilation by the unholy hand of an abstractor This is exactly the case with the article by Dr. Cam-

midge and which it would, indeed, be easier to expand into a book than to reduce to a brief abstract.

When Dr. Cammidge informs us that, within the last few years, he has examined some 8,000 specimens of blood, urine and faeces, respectively, in over 500 cases of diabetis; that one of the most striking results of his investigations has been the frequency with which indications of a chronic catarrh of the upper part of the intestinal tract have been met—namely, in 71 per cent of his cases—we will realize at once the large amount of experimental material upon which he bases his claim to the assertion that the relationship between the occurrence of glycosuria and chronic catarrh of the upper part of the intestinal tract, cannot be merely accidental.

"The fasting treatment is based on the assumption that impairment of the functions of the pancreas is the cause of glycosuria in all cases and that the improvement in carbohydrate metabolism which results is due to the physiological rest given to the gland. Although this may be true to some extent in cases with a chronic intestinal catarrh, it is probable that the starvation also has an effect on the intestinal condition and that this helps to control the glycosuria" especially, since Lombroso has recently shown that the intestine yields a glycolytic agent to the blood, even more readily than the pancreas, it is possible that the physiological rest may influence the production of this substance and so improve the utilization of sugar.

His chemical analyses alone comprise the following quantitative determinations: True ammonia N., amino-acid N., calcium, magnesium, acetone, isobutyric acid, creatinine, uric acid, total urea N., food N., food carbohydrate, indican, blood sugar and urinary sugar!

Cammidge recognizes three types of glycosuria: (1) the pancreatic, (2) the hepatic, and (3) the pancreo-hepatic. Cases of the *pancreatic type* are not materially benefited by the starvation treatment, according to Cammidge, because their digestive powers for all three classes of foodstuffs are deficient and the indications are rather to ensure sufficient nourishment than to worry unduly over the comparatively unimportant defect in carbohydrate metabolism.

The *true hepatic type*, according to Cammidge, does not come under the heading of diabetis, for, although the urine reduces Fehling and Benedict's solution, etc., and gives an osazone with phenylhydrazine similar to that of dextrose, this is not due to the presence of a sugar, but to an alphaketonic acid to which Cammidge has given the name of "isoglucuronic acid," commonly known as pseudo-laevulose, because laevorotatory, and, probably, derived from protein. "To treat such cases on orthodox lines may do more harm than good. The ordinary carbohydrate-free diet only makes matters worse and, although starvation will clear the urine of reducing substances, the same result may be obtained with greater comfort to the patient by eliminating, or strictly limiting, the protein in the diet and giving an abundance of vegetables with dextrinized starches. "It seems probable that some of the success of the various carbohydrate 'cures' for diabetis is to be explained by cures of this kind."

In cases belonging to the *pancrea-hepatic type* or "gouty" glycosuria, "it is important to remember that the disappearance of sugar from the urine does not

necessarily imply a normal blood sugar content, in fact it is the rule for the hyperglycaemia to continue after the urine is sugar-free, so that, if reliance is placed on atrolysis, of the urine alone, anti-diabetic treatment may fail to control the symptoms.

"In some cases a short period of starvation is helpful, but the best results are obtained by merely limiting the carbohydrate and protein for several days, followed occasionally by a porridge or potato day.

The "nervous factor" in the disease is shown by a very impressive chart.

Questions in regard to advising fasting: "From what I have said it will be gathered that I do not look upon Allen's fasting treatment as the best for all forms of glycosuria, although I consider that it marks a great advance in the available methods and gives results which can be obtained by no other means in many instances. It should be used with judgment, however, and one should always bear in mind that the keynote of the treatment is under-nutrition. A practical question that sometimes arises, therefore, is whether a controlled, and maybe a mild glycosuria, with an adequate diet and reasonable enjoyment of life, is not preferable to the theoretical ideal of a permanently sugar-free urine, which can only be obtained by a diet that will not satisfy the pangs of hunger and requires constant close supervision? The answer will depend on circumstances and the temperament of the patient. These should be considered carefully before advising the treatment, especially as, once it is begun, it must be continued; for as I pointed out in an article last year, the return to an ordinary carbohydrate-free diet almost inevitably brings about a rapid increase in the acidosis, with excessive tissue waste and death from coma."

Acidosis.—"Essentially, acidosis results from the imperfect oxidation of fat and this, in its turn, is dependent upon the faulty combustion of carbohydrate by the body, for fat seems to be a less readily oxidized food-stuff than sugar and needs the fire of burning sugar to bring about its complete combustion. It has been calculated that one part of dextrose to three parts of higher fatty acids is required for the purpose. If less than this proportion is available, the fat 'smokes,' as it were, the smoke being represented by abnormal acid products in the body."

Protein.—"Systematic examination of the urine shows that when the protein in the diet of a diabetic is gradually increased beyond a certain point, evidences of a disturbance of nitrogenous metabolism appear before sugar can be demonstrated in the urine and that glycosuria can be prevented if the protein is cut down. Merely to rely upon the appearance of sugar in the urine is therefore far from being an ideal method of regulating the treatment. My experience with several patients, who have come under my care after treatment with alimentary rest by others, has confirmed my distrust of this 'hit-or-miss' process of determining the protein tolerance."

The Fat Intake.—"It is of importance of not commencing the fast in severe cases of acidosis until the patient has been prepared by a few days on a fat-poor diet; but it is equally important that fat should not be added to the diet subsequently, until a considerable tolerance for carbohydrate and protein has been established."

Acid-Base Equilibrium.—"Experience has shown that the mechanism regulating the level of the blood sugar is peculiarly sensitive to disturbances in the acid-base equilibrium of the body, acid production leading to hyperglycaemia, while alkalosis exerts an opposite influence. Since meats and cereals are in general acid-producing foods, while vegetables and fruits usually yield an excess of bases, a diet rich in protein will tend to raise the sugar content of the blood whereas a vegetable diet will lower it. May this not be one of the reasons why the largely vegetable diet, usually given after the fast in the alimentary rest treatment, is associated with an increase in carbohydrate tolerance and a partial explanation of the deleterious effect of more protein than is needed for making good the actual wear and tear of the body?"

Cammidge believes a time is coming very fast, when a physician who attempts to treat a case of diabetis, guided only by examination of the urine for sugar, will be held as guilty of negligence as the present-day surgeon who failed to employ radiography when treating an injury of the bones or joints.

H. G. Beyer.

On the Complement-Fixation Test in Tuberculosis with Besredka's Antigen, by J. Bronfenbrenner, Ph.D. *The Journal of Laboratory and Clinical Medicine,* Vol. iii, No. 1, October, 1917, p. 50. Department Preventive Medicine, Harvard University Medical School.

In few diseases of an infectious nature is an early diagnosis of greater importance than in tuberculosis; in not one of them is the danger of the spread of the disease from the latest stages, the practically incurable cures to the susceptibles, more alarming. In the paper with the above title, we are told that "in spite of the great contribution rendered by Laennec himself, in spite even of the epoch-making discovery of Koch, the early diagnosis of tuberculosis is still a problem to be solved even as it was one hundred years ago in the days of Laennec." Was there ever a problem more stubborn to yield its secrets up to the biological investigator or a disease more universally elusive to the treatment of the physician?

In their efforts at finding a method by which an early diagnosis of tuberculosis could be established, numerous investigators were induced to follow the lines of the Bordet and Gengon reaction, especially in view of the remarkable usefulness of the Wassermann reaction. Bronfenbrenner expresses the belief that one of the causes for the irregularity in the results obtained by different investigators, in their study of complement fixation in tuberculosis, is to be attributed to the lack of proper antigens. When, therefore, Besredka and Manoukhine, in 1913, by cultivating tubercle bacilli on a new medium, found that such organisms showed some hitherto unknown properties, it seemed but natural to test these newly acquired properties for their antigenic values in complement fixation. In the course of these researches it was found that the complement deviation with such a tuberculin gave from 90 to 95 per cent of positive results in clinically established cases of tuberculosis and in 10 per cent of clinically non-established ones. "The antigen of Besredka consists of autoclaved filtered culture of tubercle bacillus, grown on a new liquid medium, composed

of alkaline broth to which is added eggwhite and egg yolk." The variations in the reactions that occurred are explained by Bronfenbrenner as due, partly, to possible changes of a chemical nature in the antigen, partly to the apparently different strain specificity displayed by different tuberculous sera. Even in such sera, in which a positive Wassermann coëxisted, the specificity of the tuberculin antigen could be shown. "The high percentage of negative reactions among clinically non-tuberculous (92 per cent), together with other proofs of the high degree of specificity of this reaction, seem to indicate that the comparatively frequent simultaneous occurrence of the complement-deviation test with Besredka's antigen and the Wassermann reaction in syphilitics is not due to any technical error."

With regard to the percentage of the occurrence of the reaction in the different stages of tuberculosis with purified Besredka antigen, the following "approximate" figures are given: First stage, 84 per cent; second stage, 94 per cent; third stage, 15.3 per cent.

The low percentage of positive results in advanced cases must, very naturally, attract attention aud Bronfenbrenner therefore examined a large group of such cases (from Leech Farm, Pittsburgh) with the antigens of Craig, Cooper and Calmette and, recently, with the antigen of Miller, with, however, no higher percentages than were obtained with the antigen of Besredka.

"As for the reason for this failure of advanced cases to give fixation, there can be at least two offered tentatively: one is that the resistance of the patient has been exhausted, there is no new antibody formation; and the other, that the circulating antibody is taken up as formed by the combination with antigen which may greatly increase during the last stages of the disease."

"As for the antigen to be used in the test, although we found Besredka's antigen to give the best results, we must admit that the preparation of antigen as suggested by Miller and Zinsser is much simpler and, if the results obtained with it are as good as those obtained with Besredka's tuberculin, it seems that such antigen might be more practical for use in the test."

The profession will welcome the now apparent fact "that the successful application of the complement fixation reaction for the diagnosis of early tuberculosis is already at hand."

In the reviewer's mind the questions arose as to whether this new tuberculin produced on Besredka's medium, was possessed of a higher degree of specificity than the tuberculins cultivated on other media; whether it may not be possible that the invading bacilli in the earlier stages might belong to a more virulent type of tubercle bacilli than those in the latest stages of the disease, hence the higher percentages of positive reactions. Would it be, perhaps, too much to hope for, that some day a medium would be found, so improved as to raise the specific value of the tuberculin antigen still further and to give promise of a future vaccine against tuberculosis?

H. G. Beyer.

The Treatment of Soft Chancre and of Chancroidal Bubo by Painting and Intraganglionic Injections of Sodium Arsenate, by Dr. Goubeau, Médecen-major, Chef de Centre vénéreologique aux armées. *Bulletin de l'Académie de Médicine,* Tome lxxviii, No. 34, 4 September, 1917, p. 192.

The author states that this treatment had been inspired by the method of Czerny, which consists in the painting of open chancroidal ulcers and in injections of swollen glands with sodium arsenate.

A. Soft Chancres without Complications. First steps.—Thorough cleaning of the surface of each chancroidal sore by means of a tampon saturated with ether.

Second Step.—Painting the entire exposed surface with a mixture of sodium arsenate, 1 gram; alcohol, 95 per cent, 50 grams. Sodium arsenate being but slightly soluble in alcohol and, therefore, in suspension rather than in solution, the mixture must be shaken every time it is used.

Third Step.—Evaporation of the alcohol by some current of air; thus, a fine pellicle of the arsenate of soda covers the surface.

Fourth Step.—The painting is renewed and also the evaporation; aseptic gauze completes the dressing. One or two such dressings are done daily. It is exceptional, where the chancroidal sore is not changed into a healthy granulating surface after three to four days of the treatment. After healthy granulations, free from pus, have made their appearance, they may, after washing them with ether, be dressed with iodoform.

B. Chancres with Bubo.—(1) If the bubo is still hard, an injection of 1 to 2 cc. of an aqueous solution of a 1:100 solution of sodium arsenate is given and repeated every other day. (2) If the swollen gland contains pus, it is punctured, the pus is evacuated, bridges lacerated by a turning movement of the injecting needle, before the sodium arsenate solution is injected; this injection is also given every other day. (3) If the bubo is open, it is to be treated like any other open chancroidal sore, by ether and painting with an alcoholic solution 1:50 of sodium arsenate, as above.

The results of the above treatment show a reduction of time to about half of what it ordinarily took to effect a cure.

The author concludes by citing the case of a negro from the Guianas who had suffered for six months and a half from very large chancroidal ulcers on foreskin and prepuce; all sorts of treatment, including four injections of arsenobenzol and thirty mercurial injections, had been without results. Five paintings were sufficient to change the deep, very irregular, worm-eaten chancroidal sore, with overhanging edges, into a healthy granulating wound. Repair proceeded rapidly: patient was admitted November 21, cured by December 21, left the hospital on the 27th.

H. G. Beyer.

BOOK REVIEWS

THE CARE AND TREATMENT OF MENTAL DISEASES AND WAR NEUROSES ("Shell Shock") IN THE BRITISH ARMY, by Thomas W. Salmon, Major, Medical Officers' Reserve Corps, U. S. Army, Medical Director, National Committee for Mental Hygiene. Contents: I. Introduction; II. Mental Diseases (Insanity); III. War Neuroses; ("Shell Shock"); IV. Recommendations for the United States Army; V. Appendices.

In the introduction to his report the author states "that mental and functional nervous diseases are responsible for not less than one-seventh of all discharges for disability from the British Army, or one-third, if discharges for wounds are excluded." If similar conditions may be assumed to exist among the other belligerent forces of Europe, we would simply be compelled to admit it as a general fact of experience and observation that the human *nervous* system is as liable to suffer from the injurious effects of modern warfare as are the muscular, vascular, glandular and osseous systems and other organs in human anatomy. There would seem to be nothing very astonishing about the fact nor about our present inability of preventing such injuries. Steel helmets, gas masks, breastplates and other safety devices seem but faint attempts at the protection of an organism that has not yet reached that degree of adaptation to such an environment that could be called adequate and that, when exposed to it, must suffer the consequences throughout its entire anatomy, *including its nervous system in all its extent.*

The suddenness in development of the psychoses under war conditions would point unmistakably to some physical injury to the central nervous system as the cause of it. But, where Salmon says: "I have omitted entirely any account of the treatment of organic nervous diseases or injuries to the central nervous system or the peripheral nerves," he apparently looks upon the psychoses and the neuroses as results of disturbances in a mysterious something outside of the nervous system of man which, to the reviewer, is an unthinkable proposition.

Psychiatric and neurological disease terms and our present conception of nervous disease under these, need a thorough revision before they can become acceptable to the general profession for purposes of a coöperation; they are in sore need of being passed through a clearing house for a much more strictly scientific, biological and etiological nomenclature, to begin with, and before any plans of treatment adopted under present conditions, can possibly be said to have a sound foundation or to promise enduring results to either science or patients. Much of this Babylonian confusion of terms in psychiatry, undoubtedly, is due to the abuse of that medieval and mystic adjective "mental" and of which the term *"mental hygiene,"* so frequently used of late years, may be said to be the latest and most unscientific creation of modern

superficialdom in medical nomenclature. Thus, when, for example, the report speaks of mental diseases as distinguished from "functional nervous diseases," the reviewer would ask: Are the manifestations of "mental" aberrations any less the outward expressions of an injured basal organ or organs of which a sound mind is the normal function, than are the "functional nervous diseases" the results of injured peripheral nerves and of which the normal function is undisturbed and painless conduction of impulses?

Under *"Prevalence of Mental Diseases"* (insanity), we are informed that, "on March 31, 1917, about 1.1 per cent of all patients in military hospitals of Great Britain were officially diagnosed as insane . . . the percentage among expeditionary patients was 1.3 per cent . . . about 6,000 patients are admitted annually to the special military hospitals for the insane." "It can be estimated from all the data available that the annual admission rate is about 2 per 1,000 among non-expeditionary troops and about 4 per 1,000 among expeditionary troops." "The rate in the adult male civil population of Great Britain is about 1 per 1,000." Thereupon follows a description of conditions leading to extension of hospitals for the insane, as the war went on, and quite peculiar to England, not necessarily applicable to other countries.

Under the heading: *"Clinical types of mental diseases among soldiers,"* we learn that "there are no new clinical types of mental diseases to be seen in soldiers"; "there are no war psychoses." About 18 per cent of patients are said to have been "mentally defective" and, for this, the "amazing indifference on the part of the recruiting officers to this type of disability" is blamed.

Granting the existence of a deplorable indifference on the part of recruiting officers, anxious for the enlistment of the largest possible number from a given lot of conscripts, to all objections raised by their medical assistants, it ought, on the other hand, be kept in mind that as our methods of selection at the recruiting offices are becoming more and more refined by an increase in the number of special examiners, the number of recruits finally declared as physically and mentally fit for service in the army might turn out to be very much too small. When, nevertheless, it has been shown that, mentally, defectives are promptly discovered under present war conditions, the fact would go far in proving that, in this war, the great value of the normally constituted human factor was being brought out as never before. The question interesting the medical recruiting officer at the present juncture is the following: Is there such a thing as a rough and ready guide; a, nevertheless, sure index, to which he could look for assistance in forming an idea of the mental caliber of his recruit, without being obliged to employ the finer instruments used in the special-sense examinations in psychological laboratories? In the reviewer's opinion, such a rough and ready index will be found by reference to some of his publications on the subject of "the relation between physique and mental

work."[1] The mental performances of man are functions of his physique.

We are in a better position with regard to the recognition of the syphilitic recruit and to appreciate the value of the experience of the British Army and the Navy to the effect that "no person presenting the slightest suspicion of syphilis (or injury?) of the central nervous system should be enlisted or commissioned for any military duty."

"Twenty per cent of all admissions to military hospitals for mental diseases are of the "*manie-depressive*" type; 14 per cent of the *dementia praecox* type; 7 per cent of the *epileptic* type; a large number of *alcoholies* and of the *constitutional psychopathie* type for which the term "*mental instability*" has been coined and under which the large percentage of the various disciplinary groups is enumerated.

The most interesting portion of the author's report, by far, is that part devoted to the important subject of "War Neuroses ('shell shock')." In his division of the cases into four groups, the reviewer feels strongly inclined to favor the views expressed by Mott (quoted by the author), "holding that a physical or a chemical change, at present unknown to us, must underlie such striking disabilities." The reviewer is so strongly of that opinion that he sees no good reason for excluding the fourth group from under that heading, when it is considered that no two individuals are exactly alike, that all individuals differ markedly in susceptibility, stamina, strength of make-up, resistance in different directions and through different special-sense channels of access, all of which would have to be reckoned with, when differences in the effects of even the same agents of violence upon different individuals present themselves. Although, as the author states and as everybody must admit, "very little is known regarding the physiological basis of the disorders in this group," whether endocrinitic, vascular or metabolic disturbances are at the bottom of the symptoms, *we can never escape the dominant factor of the entire organism having been exposed to violence, to an injury,* whether the effects of it be merely molecular or of a grosser nature, whether visible or not, demonstrable by instruments of precision or not, differing in different patients, interpreted and diagnosed differently by different observers, according to the symptoms presented. It is here, as elsewhere in the domain of medicine, where lies the critical point upon which success or failure depends and around which all progress revolves.

When, under the heading "*Treatment,*" our author states: "The special civil hospitals for organic nervous diseases were soon filled with patients suffering from severe neurological injuries and were able to do very little on behalf of those with functional nervous disorders," the reviewer would be inclined to believe them under the ban of a wrong and misleading conception and would ask: Are the consequences of a contusion or of a total division of some important nerve

[1] *Journal Boston Society Medical Science,* 1900, Vol. iv, pp. 121-132; 1901, Vol. v, pp. 437-446; *Am. Phys. Ed. Rev.,* Vol. v, No. 2, 1900; On the examination of navy yard apprentices, Proc. U. S. Naval Inst., Annapolis, 1900, Vol. xxvi, pp. 341-347.

trunk any less functional in character than those of a more subtle, less easily detected concussion or molecular dissolution of a more complicated deeper-lying nerve center? Is there not some physicochemical basis, necessarily to be assumed as a working hypothesis, and why should not treament be begun under such a conception and on such a basis? Why should a partial ignorance of the exact physiological condition in "functional nervous diseases" be allowed to continue to deter us from initiating a line of treatment for an injury when so much circumstantial evidence speaks so loudly in favor of it? How many diseased conditions are thoroughly known before treatment on them is begun?

Such considerations as the above are, of course and admittedly, merely the results of reasoning from general biological laws and principles, but with which the conditions in every living being must be brought into agreement; nor can any author be excused from a discussion of them in connection with a report of so important a nature as the one under review and involving the expenditure of so much in men and money.

With reference to the subject of the treatment by reëducation, our author underlines the statement: *"The function held in abeyance through neurotic symptoms must never be looked upon as lost."* The reviewer feels tempted to parallel the statement by another: the function of a broken limb is in abeyance as long as the bony fragments remain ununited; may we not, by analogy, assume the existence of a temporary discontinuity among certain nervous elements, normally belonging together, in neurotic cases, and might it not be thought possible that here, also, the securing of a period of rest for the nerve structures concerned, as a first step in the treatment, would serve as good a purpose in restoring the lost continuity and function as it does in the case of a broken arm or leg?

Finally, with regard to the very elaborate recommendations made in the report for the United States Army, based upon the author's observations in England and France, including the equipment and management of hospitals and the provisions for the care and treatment of the mentally insane and the war neuroses, the reviewer feels himself not competent to express an opinion, believing that this portion of the report should be referred to some of the leaders in management of hospitals for the insane in the country.

H. G. Beyer.

Infection, Immunity, and Specific Therapy, by John A. Kolmer, M.D. Second Edition. Philadelphia and London: W. B. Saunders & Company, 1917. 147 Illustrations, 46 in colors. Pages xii+978.

This is the second edition of Kolmer's work upon Infection, Immunity, and Serum Therapy. The first edition furnished the American

student and practitioner with by far the best work upon the subject that has appeared in the English language, and the present edition is an improvement over the first. In this edition several new subjects are considered, nootably the Schick toxin test for immunity in diphtheria, and active immunization in diphtheria with the toxin-antitoxin mixture; the complement fixation test for tuberculosis; Lange's colloiddal gold test; and a quantitative Wassermann reaction. The chapters upon Chemotherapy, Anaphylaxis, and Vaccine Therapy have been greatly enlarged and the most recent discoveries regarding these subjects have been included.

The work is divided into five parts as follows: Part I, General Immunologic Technique; Part II, Principles of Infection; Part III, Principles of Immunity and Special Immunologic Technique; Part IV, Applied Immunity in the Prophylaxis, Diagnosis, and Treatment of Disease, Specific Therapy; and Part V, Experimental Infection and Immunity.

In Part I is given a detailed and valuable description of the technique used in immunologic work and in this part are included many practical descriptions of technique which are well known in the laboratory but seldom found in text-books upon the subject. A host of practical suggestions regarding technique are included, which make this portion of the work of special value to the laboratory worker. The apparatus required, the methods of collecting blood and cerebrospinal fluid for examination, the methods of inoculating, immunizing, and colllecting blood from animals, are all clearly and very fully described, and the descriptions are well illustrated by excellent half-tone reproductions of the actual operations required in immunologic work.

Part II contains a very interesting and complete description of the principles of immunity and is especially valuable because of the open-minded attitude of the author regarding the various theories of the process that are still in an unsettled condition and admit of argument. This part also contains discussion and descriptions of phagocytosis, opsonins, bacterial vaccines, antitoxins, ferments and antiferments, agglutinins, precipitins, cytolysins, bacteriolysins, hemolysins, cytotoxins, and anaphylaxis, the subjects being considered fully from the historical, technical and practical standpoints, and each subject has added to it a description of its practical application in the diagnosis and treatment of disease, as well as in prophylaxis. This part of the book also contains detailed descriptions of the Wassermann test, the colloidal gold test, complement fixation reactions, including complement fixation in tuberculosis and the precipitin, agglutinin, and hemolysis tests which are valuable in different diseases. The author describes four different methods of performing the Wassermann test and also mentions the various modifications of this reaction that have borne the test of time. It is noted that in all of his methods the anti-sheep hemo-

lytic system is used, although he admits the advantage of the human hemolytic system. This part of the book is a veritable mine of valuable material to the student and practitioner of medicine, and especially to laboratory workers in serology and immunology. The descriptions of the various tests are detailed and accurate and are written in a style that is at once readable and easily comprehended, even by the novice in this line of work.

Part III treats of the practical application of immunity in the prophylaxis, diagnosis, and treatment of disease, and in it are considered anaphylaxis and the anaphylactic or allergic reactions, as the tuberculin reactions, the luetin reaction, the mallein reaction, and allergic reactions in typhoid fever and other diseases. The subject of bacterial vaccines is thoroughly considered from both a theoretical and practical standpoint and prophylactic immunization with vaccines is well treated. The subject of the results of typhoid vaccination in our army is discussed and proper credit given to Colonel Russell, of the Medical Corps, for the splendid results that have followed its introduction and use. In the chapter treating of passive immunity, the prophylaxis and treatment of disease by means of immune sera is considered and the subject of the serum treatment of pneumonia and of meningitis is discussed; the discussion contains all that is of value to date regarding the serum treatment of these two most important diseases. In the light of the experience of the Army with pneumonia and meningitis in our camps this portion of the book is of very special interest to the army surgeon. The subject of Chemotherapy is very thoroughly discussed, and this chapter contains much of the very valuable work of the author and his colleagues upon the toxicity of salvarsan and other drugs, and the reactions following their administration.

In Part V there is given an outline of a course in the study of immunity, divided into 60 exercises, each exercise containing the technique required for the study of the special subject treated. This part of the book is invaluable to the teacher of immunity and specific therapy, and the outline of the course of study might wel lbe adopted as a standard course in immunity.

In a brief review it is impossible to do justice to a work of this character. It is a credit to American scholarship and will always remain a classic upon the subjects of which it treats. The reviewer cordially recommends it to every scientific practitioner of medicine and to all laboratory workers as the best exposition of the subject in our language.

The book is well printed upon good paper and the illustrations and colored plates are excellent.

CHAS. F. CRAIG.

TROUBLES MENTAUX AU GUERRE, by Jean Lepine, Professeur de Clinique aus Maladies, Nerveuses et Mentales, a l'Université de Lyon. Masson et Cie Editeurs, Libraires de l'Academie de Médicine, 120 Boulevard Saint-Germain, Paris, 1917.

This is more a treatise on war than on psychiatry. It is a study of pathological mental manifestations directly and uniquely due to war, of the psychoses of war. It is a *vade meeum* for medical officers, especially those who have not specialized in neuropsychiatry. It gives a résumé of the works of specialists and at the same time the fruit of the author's personal experience. As in time of war it is necessary to act quickly, this manual will be of assistance to medical officers in forming opinions and making decisions about those complex and difficult cases, intermediate between mental health and the psychiatric state, in the situations, so frequent in war time, where prolonged observation in a special service is impossible.

It considers at first the characteristics of the different varieties of mental phenomena habitually observed in military life during war: acute troubles (mental confusion, neurasthenia, commotional state, mania, acute encephalitis infectious meningo-encephalitis, alcoholism); chronic troubles (chronic mental confusion, chronic delirium, delusions of persecutions, organic dementia, etc.). Certain special cases are described which are not a part of the clinical picture, either because they are dominated by neurologic phenomena or because they are medico-legal problems.

The same plan is followed in studying each of these troubles; diagnosis, treatment, prognosis and the rational employment of the patients.

The second part of the book reviews the subject of malingering and other medico-legal matters and discusses problems of a more strictly military nature.

FRANCIS M. MUNSON.

A SHORT ACCOUNT OF EXPLOSIVES, by Arthur Marshall, A.C.G.I., F.I.C., F.C.S., Chemical Inspector, Indian Ordnance Department. Author of "Explosives, their History and Manufacture, Properties and Tests." Twenty-nine illustrations. Philadelphia: P. Blakiston's Son and Company, 1917.

In this little book is presented in a clear and simple manner the main facts concerning explosives and their properties. It will be of use to the officers of the Army and Navy and to the large numbers of men and women who have to deal with explosives in the manufacture of munitions and other ways. The subject of explosives is such a wide one that it has only been possible to deal with the main facts and these only briefly, but those who read the book will carry away a clear conception of the different varieties of explosives.

The different classes of explosives are taken up in separate chapters headed: Black Powder and Similar Mixtures, Nitrocellulose, Nitroglycerine and Nitroglycerine Explosives, Military High Explosives, Commercial High Explosives, Smokeless Powders, Fireworks. Their history, chemical composition, manufacture, properties and uses are described.

In the chapter entitled Properties of Explosives the devices and methods for measuring and calculating the power, sensitiveness, volumes of gas formed and amount of heat generated by different explosives are enumerated. In the

chapter on Ignition and Detonation the physical phenomona involved in the development of the explosive wave are discussed and the methods for initiating it described. The book closes with a most useful and timely chapter on Precautions in which are given the precautions necessary to safeguard life, health, and property in powder factories, munition works, and magazines.

FRANCIS M. MUNSON.

"THE SPLEEN AND ANEMIA." EXPERIMENTAL AND CLINICAL STUDIES, by Richard Mills Pearce, M.D., Sc.D., with the assistance of Edward Bell Krumbhaar, M.D., Ph.D., and Charles Harrison Frazier, M.D., Sc.D., University of Pennsylvania. Philadelphia and London: J. B. Lippincott Company. Price, $5.00.

The book more than fulfils the promises held out to the student in the preface: "In this volume splenectomy is considered, first, as a means of stndying experimentally in animals the relation of the spleen to blood destruction and regeneration and, second, as a therapeutic procednre in the treatment of diseases of man accompanied by anemia," the emphasis being laid "on the side of the red blood cell and the relation of the spleen to the quantitative and qualitative changes which the red cell may undergo."

A large number of painstaking experiments, many of which are qnite original and the results of thoroughly scientific planning, were made to demonstrate and prove that splenectomy is followed by anemia, by an increased resistance of red cells to hemolytic poisons and a decreased tendency to jaundice in animals and man.

The mists in which many of the problems regarding the function of the spleen were shrouded, appear to vanish as the reader proceeds and a clearer understanding of the function of the spleen in the organism takes the place of previons doubts and uncertainties.

The reviewer's personal interest was specially attracted by chapter III in which "the supposed regulatory influence of the spleen in blood destruction and regeneration" is taken up (*A*). Experimental evidence seemed to show that hemoglobin does not appear in the urine until after it has reached a concentration in the blood serum above 0.06 gramme per kilo of body weight, that hemoglobinuria ceases whenever it falls below this amount. Hemoglobin being changed into bile pigment in the liver, these pigments continue to pass through the kidney into the bladder, unless the liver be surcharged with hemoglobin, when they are reabsorbed by the blood capillaries, pass into the tissues and give rise to jaundice. The succession of events are given as follows: The first effect of hemoglobin liberation into the blood—in small amount and slow liberation—is an increased bile-pigment content in the bile. A slightly larger amount, rapidlly liberated, will produce hemoglobinuria. A still larger amount, extremely slowly liberated, will produce bile in the urine. An equal amount, liberated at an intermediate rate, may produce both hemoglobinuria and bile pigment in the urine. While

reading these lines, the reviewer asked himself, in vain, as to what possible light these facts could throw on the still vexed question of the relation between black water fever, malaria and quinine treatment.

Of considerable importance seem to be the conclusions arrived at, after a well-conducted series of metabolism experiments: "that there is no evidence that the spleen has an influence on metabolism."

The addition to the book of the clinical studies by Krumbhaar and of the surgical treatment of the lesions of the spleen by Frazier, tend to give the book a very desirable completeness which will be greatly appreciated by both scientist and practitioner. By no means the least valuable part of the book is the splendid and very complete collection of the literature of the subject, consisting, as it does, of 486 references.

H. G. Beyer.

Blood Transfusion, Hemorrhage and the Anemias, by Bertram M. Bernheim, A.B., M.D., F.A.C.G., M. O. R. C., U. S. A., etc. Philadelphia: J. B. Lippincott Company. Price, $4.00.

In this book of 247 pages, the three related and important subjects are, perhaps, for the first time, treated together, discussed from every angle and presented to the student in a most delightfully clear and simple language. The different chapters bespeak and portray the actual experience of a skilled observer, of a faithful and accurate recorder of facts, thus attaching to the book the two chief and requisite characteristics of a contribution to knowledge of enduring value.

In the various tables exhibiting the classifications of hemorrhages and in the descriptions of the methods for making the differential diagnoses from other pathological conditions, the essential points to look for are brought out with unusual clearness. Some of the histories, cited by the author for the sake of descriptive illustration, are positively striking. Thus, for instance, the tragic stories of (1) the fulminating streptococcus peritonitis, following an abdominal operation, simulating concealed hemorrhage and (2) the instance of a case of heart-collapse, approximating the same condition, are little short of thrilling.

In cases of delayed recovery due to shock, the author, apparently, places little reliance on blood counts and hemoglobin determinations for the confirmation of a differential diagnosis, except some time after the occurrence of the hemorrhage. More and much greater importance is attached by him to a persistently decreasing blood pressure. In actual hemorrhage, the patient's countenance, termed by him *"cadaverously cyanotic,"* is decisive.

With regard to former methods in practice for the control of hemorrhage by the use of drugs and the abuse of salt solution, the author, from seemingly bitter personal experience, has this to say: "That any truly serious hemorrhages were successfully combated is a wonder and that more fatalities did not occur speaks rather for nature's re-

cuperative powers than for the medical man's skill and comprehension." He holds that a few hundred cc. of salt solution is all that is needed to tide a patient over a dangerous period, but if 1,000 to 1,500 cc. do not steady a falling blood pressure or cause a slight rise in it, its further introduction had better be discontinued, adding that *"it never raises a pressure twice."*

New blood must be introduced and "a baseline of 70 mm. of mercury must be assumed as the indication for immediate blood transfusion, regardless of all other features of the case." The only real danger in blood transfusion is said to be that resulting from hemolysis and agglutination, and this danger can be eliminated by a previous careful examination of both the blood of the donor and that of the recipient. The gradual rise of blood transfusion-methods out of a chaotic and empiric past, to their present state of a perfectly safe, almost guaranteed, practicability, in skilled hands, of course, is most convincingly described. Of the three methods: the direct, the indirect—whole-blood, and the indirect-anticoagulation-method, the indirect citrate method of Lewisohn is pronounced, by the author, as the present method of election: "But I am frank to admit that no method and no instrument is comparable in facility and elasticity to the citrate method of transfusion and I feel that a debt of gratitude is owing to Drs. Lewisohn, Weil and Agote for working out its details so carefully."

This truly great result of coöperation—biological laboratory work represents but another triumph of our much maligned, scientific research men, over their misguided, though, perhaps, equally sincere opponents.

H. G. Beyer.

Medical Research and Human Welfare. A Record of Personal Experiences and Observations during a Professional Life of Fifty-seven Years, by W. W. Keen, M.D., LL.D. (Brown), Emeritus Professor of Surgery, Jefferson Medical College, Philadelphia. The Colver Lectures in Brown University, 1917. Boston and New York: Houghton Mifflin Company, 1917. Price, $1.25.

Professor Keen's long and active professional career as practitioner and teacher eminently qualifies him to write this series of lectures which show the false position held by those who protest against medical research. A wide circulation of this book among the unenlightened laity would go far toward counteracting the misconceptions generated in the minds of those influenced by the publication in *Life* and other periodicals of misleading cartoons and verbiage.

He speaks of the new types of physicians and surgeons bred by experimental research and traces the development of modern surgery from pre-antiseptic days to the "mathematical surgery" whose chief exponent is Carrel. He refers in an interesting manner to the instruments of precision that have come into general use during his professional lifetime, among others the microscope, the clinical thermometer, the hypodermic syringe, the various "scopes" by

which we can look into various cavities of the bodies, the X-ray and blood pressure apparatus.

He describes Pasteur's great work and the inestimable benefits conferred upon all mankind by his proof of the bacterial origin of infectious diseases and fermentation. Pasteur's individual services in saving the silk-worm industry of France, his discovery of the protective inoculations against anthrax, chicken cholera, swine plague and hydrophobia and his demonstration of the cause of puerperal fever are recounted. How anyone who loves his fellow-man more than the brute creation can read this and not be convinced that the vicarious sacrifice of relatively few of the lower animals is not preferable to the premature death and unnecessary suffering of millions of human beings is beyond the comprehension of the reviewer.

Professor Keen's dissertation brings out the fact, apparently lost sight of by misguided enthusiasts, that these animals experimented upon are martyrs. By their own death countless thousands of their species are conserved for useful purposes.

He refers to the relation of medical research to our present knowledge of the communicable diseases of men and animals. The internal secretions and ductless glands are discussed in a most illuminating manner.

Professor Keen, in this record of personal experience and observation, has given us a vista of the medical progress of the past half century and has added to the obligations we are all under to him, whose long and useful professional career is an inspiration to all surgeons.

FRANCIS M. MUNSON.

THE IMMEDIATE CARE OF THE INJURED, by Albert S. Morrow, Clinical Professor of Surgery in the New York Polyclinic. An octavo of 356 pages with 242 illustrations. Philadelphia: W. B. Saunders Co., 1917. Cloth, $2.75.

Part I, consisting of 106 pages, deals with the anatomy and physiology of the human body, the first 42 pages describing the bones and joints and the remaining pages covering practically the entire body. It is obvious that the subject is necessarily dealt with in the briefest manner, and that anyone who has ever studied anatomy or physiology would learn little from it. However, those who are ignorant of the structure of the body and yet wish to learn the principles of first aid will find this introduction valuable. The text is clear and concise and the 62 illustrations in this section make the location and structure of the various organs clear to the novice.

Part II deals with bandages, dressings and practical household remedies in quite the usual manner. The common bandages are illustrated.

Part III. Here accidents and emergencies are discussed, including hemorrhage, contusions and wounds, burns and scalds, fractures, dislocations and sprains, asphyxia, unconsciousness, poisoning and its treatment, the transportation of the injured and the preparations to be made in the house for an accident case.

For elementary instruction in first aid the book should serve a useful purpose. Since this is a third edition, this constitutes proof that the book has already been useful to many. It would not be of great value in the service since it contains little that is not included in Mason's Handbook or in the drill regulations for the Hospital Corps.

EDWARD B. VEDDER.

MEDICAL OPHTHALMOLOGY, by Arnold Knapp, M.D., Professor of Ophthalmology, Columbia University. Illustrated. Philadelphia: Blakiston's Son and Company.

This work is one of the international system of Ophthalmic Practice, edited by Walter L. Pyle, M.D., Philadelphia, and is a worthy addition to that system. Commencing with an introductory chapter on the anatomy and physiology, with topographical diagnosis, giving a number of illustrations showing the relationship of the optic nerve and tracts, it then proceeds with the discussion of intracranial optic path lesions. Following this, the diseases of the nervous system affecting the eye are reviewed.

The third section on diseases of the glands with internal secretion is, perhaps, not so large and elaborate as one would wish, particularly in view of the increasing study and attention devoted to these obscure conditions. No backing can be found for the enthusiast in Dr. Knapp's treatment of this subject.

In the discussion of poisons and infectious diseases, but little new has been brought forth. The chapter on circulation covers the subject fully and clearly and, under diseases of the respiratory system, the conditions of the accessory nasal sinuses and the optic nerve complications of sinus diseases are taken up. The distinction in visual field findings, depending upon whether the antrum and anterior ethmoids or the posterior ethmoids and sphenoid are involved, is drawn upon enlargement of the blind spot.

Chronic sepsis, due to the teeth, is treated in detail, and the dependence of certain cases of irido-cyclitis upon pyorrhea, as accepted by Lawford, is given. Reflex neuralgias localized in the eye, or back of the eye, with asthenopic symptoms, attributable to defective teeth, are seen. Autointoxication, particularly intestinal, as a cause for eye affections, is discussed, and the views of de Schweinitz that uvetitis is of septic or toxic origin is favored. Absence of indican is not a proof that autointoxication does not exist. In general, focal infections may be found in the following locations: First, nasal accessory cavities; second, middle ear and antrum; third, tonsils; fourth, alveolar processes; fifth, genito-urinary tract; sixth, gastrointestinal tract.

Eye involvements in nephritis are classified, according to the ophthalmoscopic picture, into three groups: (1) albuminuric retinitis (77 per cent); (2) hemorrhagic retinitis (14 per cent); (3) optic neuritis (7 per cent). The distinctive diabetic changes are retinal hemorrhages and diabetic cataract.

Circulatory disturbances are of great importance, and may be hemorrhages in any part of the eye, particularly striking in case of embolism and thrombosis of the central retinal artery. Arteriosclerotic changes are relatively frequent and vary, from mere narrowing of the vessel with widening of the light streak, to a silver wire appearance. Retinal hemorrhages often occur.

The last chapter, on hereditary eye diseases, lays stress upon the hereditary influences in glaucoma, retinitis pigmentosa, night blindness, and nystagmus.

G. B. Trible.

Traitement des Fractures, par R. Leriche. Fractures Articulaires, deuxieme edition. Precis de Médicine and de Chirurgie de Guerre. Paris: Masson and Co., 1917.

In his introduction to Treatment of Fractures of the Joints, Leriche divides his subject in the following way: (1) The anatomical types of wounds and their clinical evolution; (2) the immediate therapeutic indications at the Front within the first twenty-four hours; (3) the technical indications necessary to obtain good functional results; (4) the post-operative care; (5) how the wounded should be transported; (6) the treatment of wounds seen secondarily or late.

After a general discussion of articular wounds, their seriousness and their treatment, the author takes up in succession the shoulder, elbow, wrist, hip, knee and ankle. As early operation as the circumstances will admit is urged, and the removal of all loose fragments and foreign bodies. The exposure of the medullary cavity in order to sterilize any infection, provided fragmentation has opened it. In partial or complete resection the work should be carried out in a true subperiosteal and subcapsular manner; this is the keynote of success from the standpoint of good functional results. The after-care is well described. Leriche is noted for his radical practice, but his results, based upon a wonderfully large experience at and near the Front, justify his teachings as probably the best to follow. His experience and teachings of the treatment of war fractures of the diaphyses are in the same line as those of joint fractures.

In the December 25th number of the Bulletins et Memoirs de la Société de Chirurgie de Paris will be found a report by Leriche proving in a convincing way the wisdom of his practice. A large number of radiograms were exhibited showing the callus obtained and the favorable end results in war fractures of all of the large bones of the body. The report was based upon a series of twenty shaft fractures treated by primary subperiosteal removal of all loose fragments, all being operated within from seven to eighteen hours after the injury; there was perfect consolidation obtained within the usual time for normal repair. This work is corroborative of Leriche's technique recommended in his little book upon joint fractures.

It would appear desirable that our American surgeons should make a close study of the recorded experiences of our French colleagues, so that our own wounded may have the advantage of these experiences.

JNO. E. SUMMERS.

INTERNATIONAL CLINICS, a Quarterly of Illustrated Clinical Lectures and Especially Prepared Original Articles on Treatment, Medicine, Surgery, Neurology, Pediatrics, Obstetrics, Gynecology, Orthopedics, Pathology, Dermatology, Ophthalmology, Otology Rhinology, Laryngology, Hygiene, and other topics of interest to Students and Practitioners, by Leading Members of the Medical Profession throughout the World. Vol. IV, Twenty-seventh Series, 1917. Philadelphia and London: J. B. Lippincott Company.

In a general way what was recently said in the March number of THE MILITARY SURGEON, of Volume III, *International Clinics,* can be said of Volume IV, a most excellent book.

It opens with a clinic on "Military Bone Surgery" by Dr. Fred H. Albee, who states that the clinic is given to teach fundamental principles. The first case is one of a mal-united fracture of the lower left tibia and fibula, which the doctor corrected by skillful carpentry work with his ingenious motor saw; case 2, one of tuberculosis of the hip-joint, which was treated by open incision and the use of the curette, bone-gouge, etc.; case 3, one of infantile paralysis, also subjected to operation; case 4, one of recurrent sub-luxation of the patella; case 5, old un-united fracture of the tibia, submitted to operation; and case 6, chronic osteomyelitis of the lower end of the tibia, in which a large cavity was exposed through a trap-door incision of the bone, by means of the electric saw—the patient was a child two and one-half years old. The cases presented are all instructive and interesting, and were operated by the *master* Dr. Albee is known to be, but we would rather think that this teaching could be more advantageously done from every standpoint upon patients admitted to the accident wards of a large hospital. It looks more like putting the cart before the horse, reconstructive surgery being taught before the fact.

This lecture of Dr. Albee's is followed by an excellent orthopedic clinical lecture by Dr. G. G. Davis of Philadelphia. Next comes the clinic by Dr. Arthur Dean Bevan, of Chicago, which conveys much valuable information not to be found in text-books. It is a heart-to-heart talk which could be read with profit by any doctor. Dr. F. H. Lahey, of Boston, has another very interesting operative clinic.

Drs. McCallum and Clinton K. Smith, of Kansas City, have an up-to-date clinic on the subject of Ureteral Calculi, illustrated by several excellent skiagrams which really *illustrate* the text.

Dr. Charles Greene Cumston, of Geneva, Switzerland, has two well-written practical lectures on Injuries to the Cranium and Brain in Warfare, and there are two interesting surgical clinics given by Dr.

H. H. Grant, of Louisville, Ky., and Drs. Speese and Skillern, of Philadelphia.

Dr. Julius Grinker, of Chicago, presents the subject of Multiple Neuritis in a most instructive way. His cases are taken from real life, a clinic at Cook County Hospital.

There are several other valuable papers; one on Brain Tumor of Obscure Origin, another on Primary Tumor of the Heart, and another on Treatment of Mental Backwardness in Children, besides useful articles on Public Health, Ether Anesthesia, and "Some Food Facts for Wartime Consideration." JNO. E. SUMMERS.

PLAIES DE LA PLEURE ET DU POUMON (Wounds of the Pleura and the Lung), by R. Grégoire, professéur agrége à la Faculté de Paris, chururgien de Hopitaux, et A. Courcoux, medicin des Hopitaux. Masson et Cie, Editeurs. Paris, 1917.

The authors have taken for their base a considerable number of observations of wounds of the lungs and pleura and have, quite naturally, defended the ideas that have appeared to them the best. They have nevertheless tried to present whenever possible the efforts of all those who, during the war, have related their observations.

The little volume covers, in both a didactic and a practical way, the field of traumatic pulmonary surgery in the light of the revolutionary changes made in the subject by the work of the military surgeons during the great war now raging. The authors agree, in the main, with the teachings and conclusions of the Dr. Pierre Duval, whose recent book, "Plaies de guerre du Pouman," was reviewed in this magazine. FRANCIS M. MUNSON.

CHIRURGIE DE GUERRE LES FRACTURES. Deplacements, Sequelles, Decalcifications, Raideurs Articulaires Consécutives (Avec. LV Planches et 304 Figures). Paris: Imprimerie Librairie Militaire Universelle. L. Fournier, 264 Boulevard Saint Germain, 1917, by Professor Edmond Delorme, Medicin Inspecteur General de l'Armée, Ancien Président du Comité Technique de Sante, Membre de l'Academie de Médicine.

We have in this work a complete, thorough and up-to-the-minute manual covering every phase of a most important subdivision of the surgery of warfare. As fractures represent five-sixths of the wounded whose treatment and convalescence are necessarily prolonged and four-fifths of the causes of invalidism, their importance can be well appreciated.

The first chapter embodies a complete description of all types of fractures, common and exceptional. The second chapter deals with the diagnosis and treatment of fractures and their sequelae. The third chapter is devoted to the subject of the atrophy of bones following the traumatisms of war and the fourth to stiff and ankylosed joints following war wounds and the respective rôles of mechano-therapy and orthopedic surgery.

Coming from the pen of an authority on the subject and being the result of the study of thousands of cases the book is absolutely dependable and has much to recommend it. FRANCIS M. MUNSON.

MILITARY MEDICAL ADMINISTRATION, by Joseph H. Ford, Colonel, Medical Corps, U. S. Army. Philadelphia: P. Blackiston's Son & Co. Price, $5 net.

In writing this book Colonel Ford has assembled material that should be of direct practical value to every medical officer in the service. The duties that a medical officer may be called upon to fulfill are so variegated that even officers of many years experience can hardly have become familiar with all the details of medical department administration. The man who is thoroughly familiar with hospital administration in all its branches may know nothing of the administration of a medical supply depot, and he very probably does not know how to pack a mule.

To the newly joined medical officer the book should be invaluable. Colonel Ford expresses a sentiment which is well nigh universal when he says that "he has a keen recollection of the difficulties attending his early attempts to observe official technicalities." Reminiscences are apt to be painful to the reader, but the critic also still feels chagrined when he remembers all the *faux pas* committed when, less than a month after joining the service, he was ordered to a manuver camp as regimental surgeon, without anything but a very faint conception of the duties to be performed. The ordeal lasted a month, during every day of which a book like this of Colonel Ford's would have earned its purchase price. It is further to be noted that General Gorgas, in a letter printed in the introduction, states that "I hope every medical officer in our service will furnish himself with a copy." This is a very unusual recommendation and can only be attributed to the great value of the book to all medical officers in the performance of their duties.

Critics appear to think that no book review is complete unless a few of the author's errors are pointed out. The custom still obtains in spite of the fact that anyone who has ever tried knows that it is impossible to write a book without making a few errors. There are very few such errors in this book, but it was noted that on page 82 the statement was made that "to eradicate fleas it has been advised that the small animals that are usually present with a command in the field be driven off or at least be rid of the insects." Is it not a fact that the dog or cat flea does not annoy man so long as its preferred hosts are present? The human flea is derived from quite other sources. Such criticisms, however, are unimportant. If any criticism of the book is valid, it is that the volume is a trifle large and heavy, and that part of this size is due to repetitions and the inclusion of matter which is contained in the regular manuals and to which references could be made. Considerable space is occupied in dealing with general principles of sanitation, which seems unnecessary in view of the fact that Colonel Ford is the author of a separate book on Field Hygiene and Sanitation. Again, however, this is not serious, and these trifling criticisms should not be considered to detract from the value of the book as previously stated.

EDWARD B. VEDDER.

INSTRUMENTS AND APPLIANCES

APPLIANCES USED IN THE EARLY CARE OF GUNSHOT WOUNDS OF THE JAWS AND SURROUNDING SOFT PARTS [1]

(With fifteen illustrations)

THE established principles of surgery and the trend of thought of all workers abroad, as expressed in their writings and verbal reports, are sufficient authority for basing our preparation on the theory that a definite plan of treatment of face and jaw injuries should be initiated at the earliest possible moment after the receipt of the injury. Our preparation has included appliances that it is hoped will expedite early treatment of these cases.

Intratracheal Anesthesia Apparatus

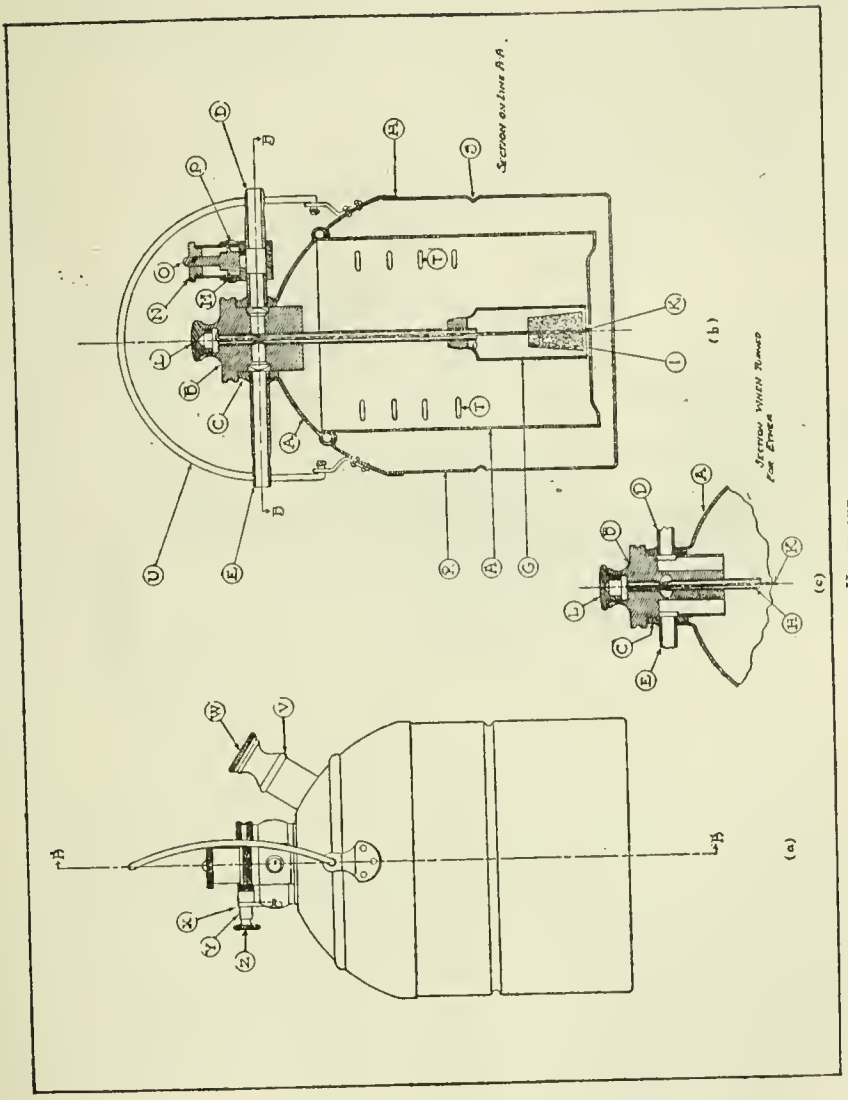
The utility of intratracheal anesthesia for certain types of operations is well established.

Vaporizer (Fig. 1).—The vaporizer that has been recommended to the Supply Department of the Army was developed with a view to efficiency, compactness, simplicity, and durability. To avoid breakage it is made entirely of metal. It consists essentially of an ether chamber *A*, and a control valve *BC*, with accessories. Air from a dental bellows is led into the pipe *D* to the valve *BC*, which is a two-way valve made so that either all of the air will pass straight through to the outlet pipe *E*, or all of the air will pass down into the ether chamber *A*, to return after being saturated with ether vapor out through the pipe *E*, or any desired mixture of ether-saturated air can be obtained.

Ether Gauge.—The cylinder *G* attached to the valve *B* by the tube *H* contains a cork float *I* attached to the stem *K*, which passes through the tube *H*. By removing the cap *L* the cork and stem can float up to indicate the height of the ether, which should not occupy more than one-third of the chamber *A*.

Safety Valves.—*MNOP* is a release valve to limit the air pressure. *P* is a sliding collar around the valve case. There are lateral openings in the upper and lower parts of the case, either set of which may be covered by the collar *P* by shifting it up or down. With the lower apertures open the valve releases at 25 mm. Hg. pressure; with the lower openings closed and the upper open, the valve re-

[1] Submitted by the Section of Plastic and Oral Surgery and approved by the Surgeon General, U. S. A.



VAPORIZER.
Intratracheal anesthesia apparatus.

leases at 15 mm. Hg. pressure. The control valve *B* rests in its seat by its own weight and will rise and release the pressure at 30 mm. Hg. when air is entering the ether chamber.

The Hot Water Jacket R is marked by the groove *S* which shows the height to which it is to be filled. The lugs *TT* on the outer surface of the ether chamber allow the latter to be immersed in the water to various depths as desired.

The *Bale U* is curved so as to avoid the pipes *D* and *E* and to lie flat against the water jacket.

The Ether Spout V, closed by the screw-cap *W,* is placed at such an angle that it will receive ether from the full can.

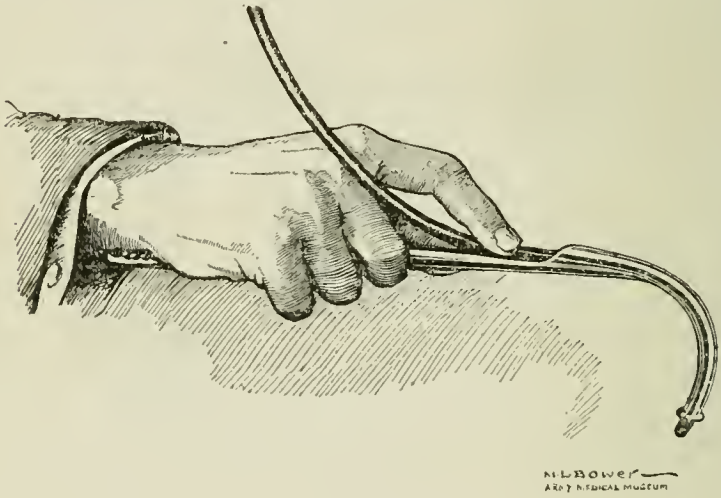


Fig. 2.

The Indicator at *X* will show the relative proportions of pure and etherized air that are being fed to the catheter in the trachea.

The Valve Lock Y will fasten the valve stem *B* so that it cannot fall out of place during transportation and is fixed by the screw *Z*.

Accessory Equipment:

Intratracheal catheter introducer (Cotton-Boothby	1
Mouth gag	1
Tongue forceps	1
Intratracheal catheters (Porges or Eynard)	6
Canvas roll for above articles.	
Bellows, dental	1
Rubber tubing, ¼ inch by 6 feet, pieces	2

Method of Use.—The patient is etherized with an open mask until well relaxed. The ether chamber is filled with ether until the indicator ceases to rise, and the cap *L* is screwed in place. The

water jacket *R* is filled with water at 95° F up to the groove *S*. The ether chamber *A* is suspended in the water jacket just above the level of the water. The bellows is attached to the pipe *D* by one rubber tube. The other rubber tube it attached to the pipe *E*. The indicator *X* is placed on *A*. The patient is rather deeply etherized by the open method.

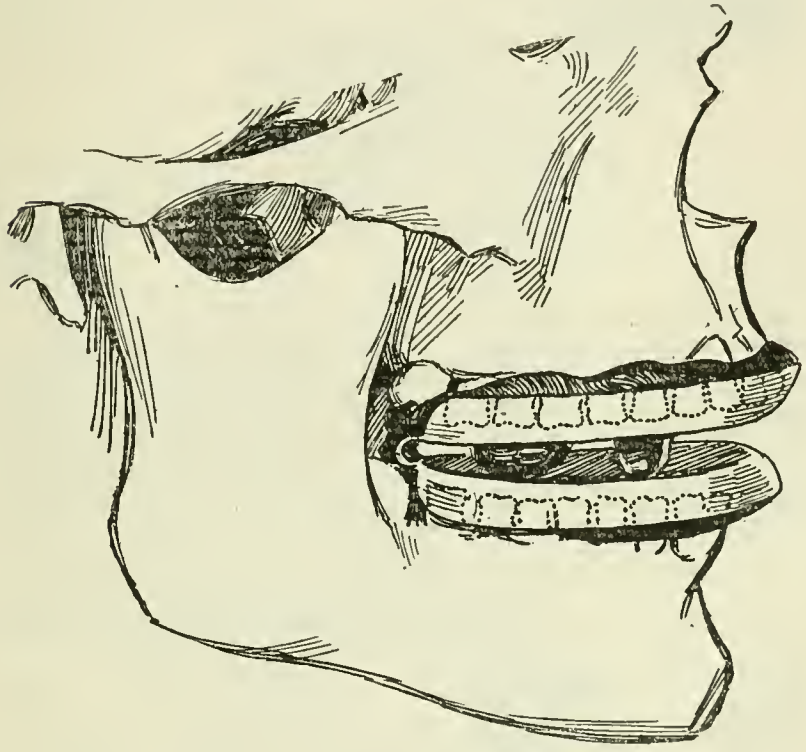


Fig. 3.

The catheter selected is sterilized by boiling for two minutes in water free from alkali and is greased with vaseline, care being especially taken to grease the eyes of the catheter. The anesthetist stands on the patient's right side with the introducer threaded with the catheter, allowing about three-quarters of an inch of the catheter to project beyond the tip of the introducer (Fig. 2). A catheter should be selected that is about half the diameter of the lumen of the trachea.

The assistant stands at the head of the table, places the gag in position on the left side of the patient's mouth and opens the mouth moderately. The assistant then steadies the head in the median line in normal extension. The anesthetist holds the tip of the tongue—either

with tongue forceps or gauze—and exerts moderate traction. With the left forefinger the anesthetist feels for the epiglottis and, with the forefinger over it, pulls the epiglottis and tongue forward. The right hand now releases the tip of the tongue, and the threaded introducer is passed

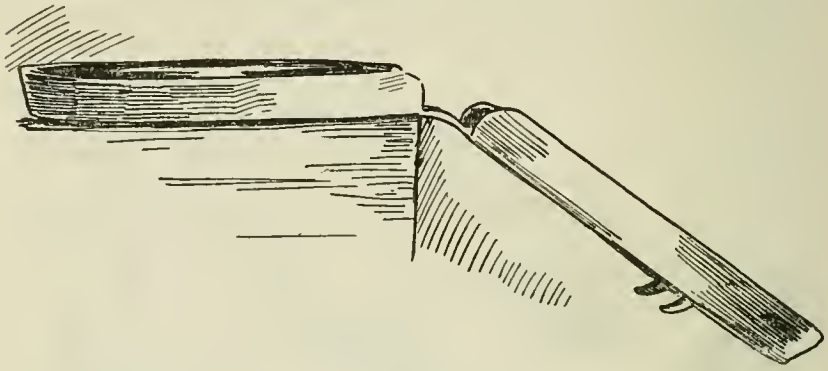


Fig. 4.

behind the epiglottis until the catheter engages in the larynx. The introducer will now hold the tongue and epiglottis forward, and with the left hand the catheter should be gently pushed down for 4 or 5 inches. The introducer is now withdrawn till the catheter can be grasped with the thumb and forefinger of the left hand and the introducer unthreaded. The catheter should now be pushed down to a depth of 22 or 24 cm. from the front teeth."—*Richardson.*

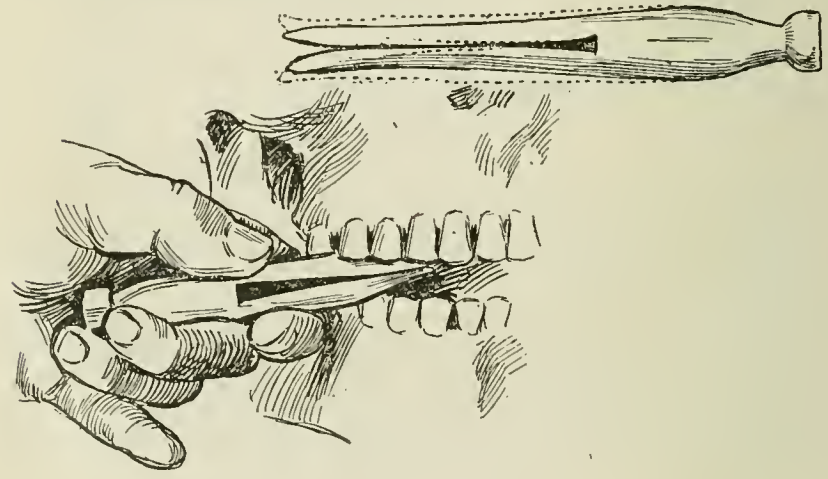


Fig. 5.

N. B.—No. 22 and No. 24F Eynard or Porges two-eyed tubular gum elastic catheters are most suitable for intratracheal anesthesia. The Cotton-Boothby introducer should be made of sufficiently large

size brass tubing to allow the No. 24 catheter to pass through the curve freely.

If the patient is not deeply enough etherized before the introduction, there will be coughing or spasm of the larynx. If this occurs there should be no attempt to force the catheter down. The anesthetist should exert gentle pressure until the spasm ceases, or the patient should be more deeply etherized and a second introduction made.

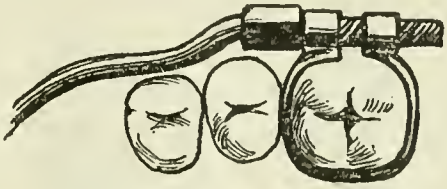


Fig. 6.

In most cases the catheter can be inserted in the larynx with the fingers, using the same technique without the aid of an introducer, particularly if the assistant elevates the larynx by grasping it with the thumb and fingers of the left hand.

If, the patient lying on the back and the head hanging over the end of the table, the root of the tongue be carried forward by a curved spatula pressing on its pharyngeal surface, a direct view of the rima glottidis may sometimes be obtained. Direct vision by means of a laryngoscope or bronchoscope may also be employed.

Fig. 7.

As soon as the catheter is in place in the trachea the tube from the vaporizer (with the valve set at *A*) should be attached, and with the beginning of regular respiratory movements the ether tension should be increased until the proper proportions are reached. The junction of the catheter and the vaporizer tube is fixed by a strip

of adhesive plaster, and the catheter is fastened to a convenient part of the upper lip or cheek by adhesive plaster.

The anesthesia should not proceed until the anesthetist has satisfied himself by feeling at the glottis that the catheter is in the larynx.

Caution.—It is necessary at all times after the introduction of the catheter to keep a current of air or vapor flowing through it. It is also necessary to be sure that there is a clear airway for the expiration of the vapor from the lungs. Nasal tubes may be used to main-

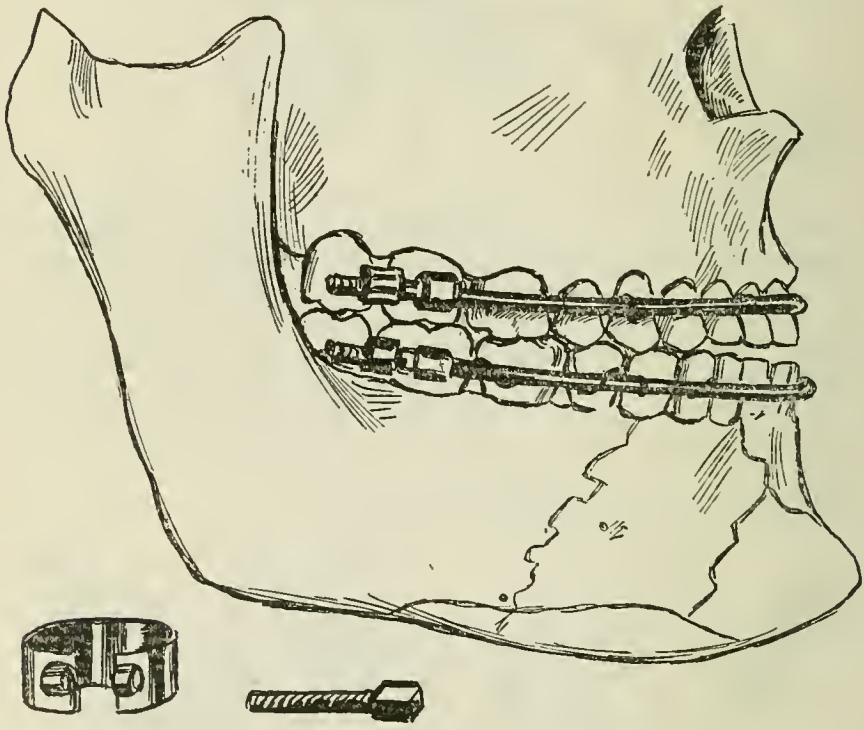


Fig. 8.

tain airway, and are necessary in all cases where the pharynx is to be packed. The diaphragm of the bellows should be moderately but not tightly distended during the whole anesthesia. At the termination of the operation pure air is pumped through the catheter until the pharyngeal reflexes return.

The percentage of ether vapor in the air depends on the adjustment of the mixing valve, the rapidity of pumping, the temperature of the room, the temperature of the water in the bath, and the extent

to which the ether chamber is immersed in the water. Therefore, in using these controls, the anesthetist is guided by the condition of the patient. The air pressure may be governed by the set of valve *MNO* and the rapidity of the pumping.

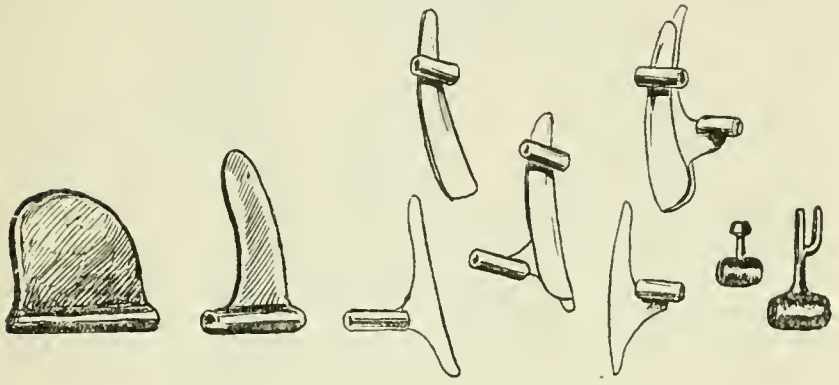


Fig. 9.

ADJUSTABLE GUNNING OR OPEN BITE SPLINT FOR EMERGENCY TREATMENT OF FRACTURE OF EITHER JAW.

Indications.—It is desirable to fix fractured jaws at the earliest possible opportunity. This splint is provided to facilitate early fixation. Early fixation will tend to lessen hemorrhage, to control sepsis, and to lessen pain.

Limitations.—The splint is intended only for temporary treatment until the patient can be transported back to a base hospital. It is not believed that it will always bring the fragments to exact alignment.

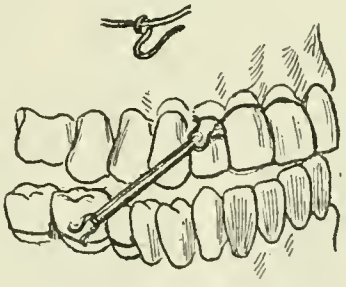


Fig. 10.

Directions for Use.—Bending.—The pillars are to be turned down, and the splint bent to the form shown in Fig. 4. To do this one tray is laid on a flat surface with the posterier ends of the tray corresponding exactly to the edge of the block and the splint bent to

an angle of 137 degrees (Fig. 3). The other tray is then placed on the block and the bending continued to 90 degrees. The bending is completed in the hand.

Adjustment.—The splint is then placed in the mouth to determine if further adjustments are needed. The arch of the trays may be compressed or expanded or any part of either wall bent or trimmed away.

Application.—Both trays are filled with modeling composition, made very soft either in hot water or over a flame. The splint is placed in the mouth and the teeth of the uninjured or least shattered jaw are pressed deeply into the modeling composition. The remaining fragments of the injured jaw are assembled into the best obtainable position and the teeth of this arch are also forced into the composition of the other tray. If necessary, the splint may be removed and re-heated. Replacing it, the composition is pressed about the crowns of the teeth. Dressings and a chin bandage, preferably elastic, are applied. A chin cup of modeling composition applied over light dressings under the bandage will add to stability. If it is desirable, the anterior ends of the two trays may be anchored together by a wire ligature.

Drainage and repair of soft parts.—If possible, at the time the splint is inserted, dependent external drainage should be established at the lines of open fractures. If wounds of the cheek or lips are immediately sutured, the splint may be retained until the facial wound heals sufficiently to allow of its removal.

Removal.—The mouth is to be irrigated with warm water until the composition somewhat softens, then the splint is gently loosened from the teeth. This may be facilitated by bending the pillars and removing the composition from between the trays.

Caution.—No open bite splint of any kind should be used as permanent treatment in a case where there is a fracture of the mandible so far back that the posterior fragment will not engage in the splint. If the posterior fragment is not controlled by an open bite splint that is used as the final fixations mal-union with a permanent open bite may result.

Copper Ferrules (Splints made from).—Copper ferrules of various sizes are furnished in the Base Hospital Unit. These may be used as follows: Ferrules of proper size are conformed to teeth to be used for anchorage. They may be trimmed and burnished so as not to extend above the masticating surfaces. An impression is taken in modelling composition with the ferrules in place on the teeth, the ferrules being removed with the impression. If not removed with the impression or if the latter be of plaster of Paris, the ferrules

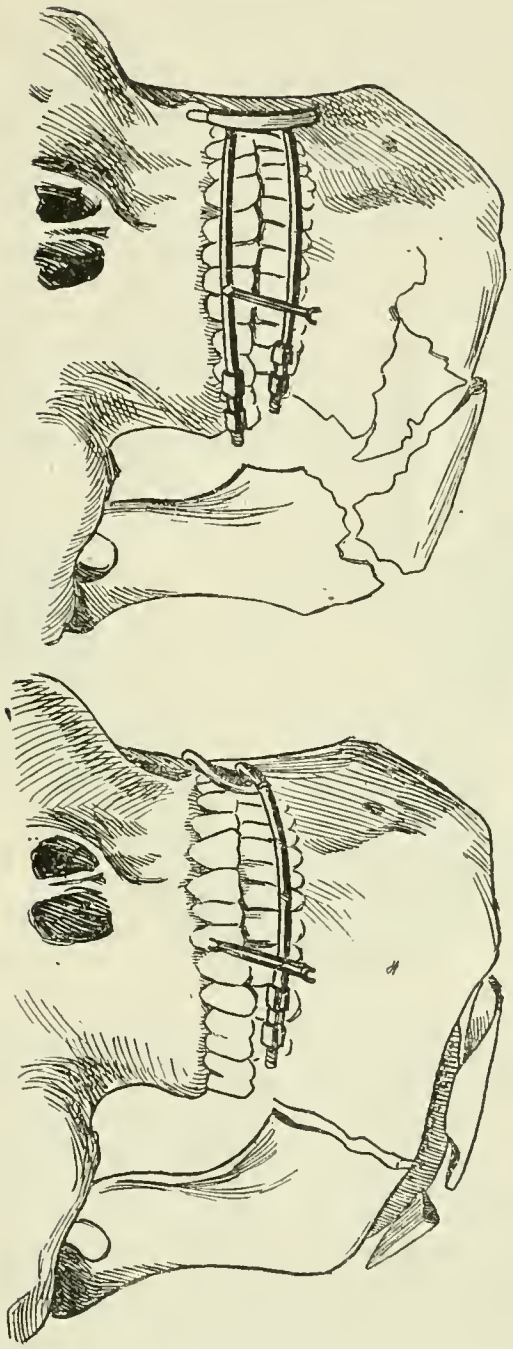


Fig. 11.

should be placed in the impression in proper position before pouring the positive cast. After softening and removing the impression composition, the ferrules should now be found in their proper positions on the teeth of the cast. The plaster of Paris denture is, if necessary, reassembled to its correct relation with the opposing teeth, and the ferrules in their new relation are connected by one or two heavy wire arches with soft solder and an iron, which completes the splint.

Chin Cups.—These may be made of cardboard, metal, etc., but at present modeling composition is furnished for this purpose. Two cakes of ordinary size are softened in hot water or over a flame and kneaded together to make a cake about 5 by 25 cm. With the jaw fragments held in the best procurable position, the soft modeling composition is placed transversely under the chin over a single layer of gauze or light dressings and bandaged in that position. The jaw fragments are to be held in the desired position with the fingers until the composition hardens.

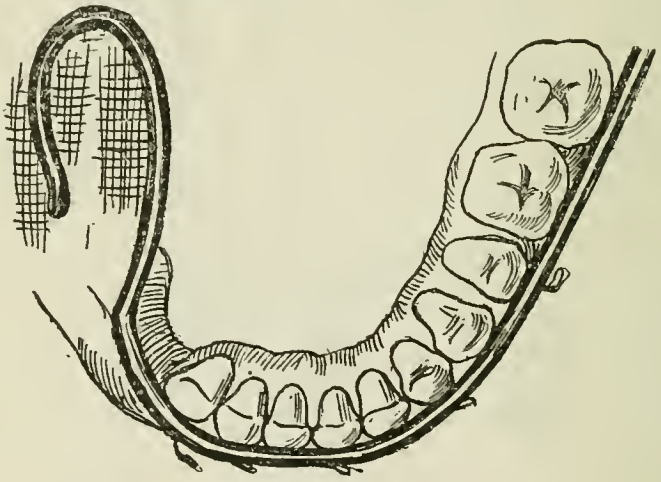


FIG. 12.

Jaw Dilators "Prinz"—Wooden Clothes Pins.—These are furnished as a substitute for simple wedges to overcome trismus or scar contractions that bind the jaws together. The patient is furnished with one or two pins which have been trimmed so that when compressed the end can be just entered between the occlusal surfaces of the molar or premolar teeth (Fig. 5). The elasticity of the legs of the clothes pin will gradually overcome muscular or soft scar resistance. The patient is instructed to use the pins as frequently and for as long a time at each sitting as seems advisable. If further mechanical dilatation is desired the steel dilator in the neurologic

and plastic and oral surgery instrument roll may be used, or one formed of wood to resemble a glove stretcher.

Head Band (Aiguier's).—This is adjustable as to size, and on either side has a row of hooks to which a maxillary splint may be attached. The posterior steel band gives stability.

Chip Blower (for irrigation).—A chip blower can be used conveniently as a hand irrigator.

Dental Analgesic.—Eugenol comp. is furnished in the evacuation hospital as a dental sedative.

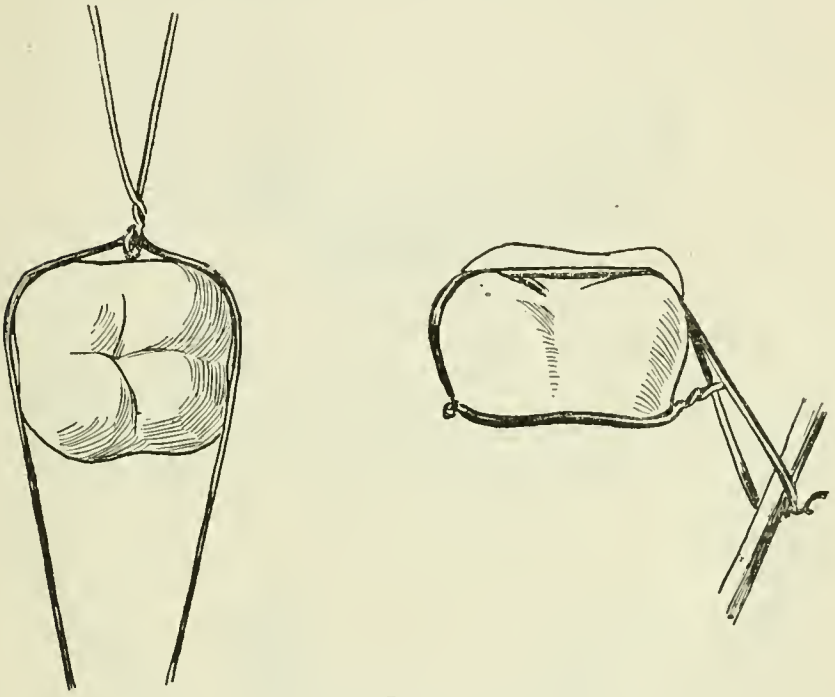


Fig. 13.

THE USE OF CLAMP BANDS AND WIRE ARCHES IN THE TREATMENT OF FRACTURES OF THE JAWS

The lower jaw may be ligated to the upper by the use of clamp bands and ligatures. A Usona type clamp band may be placed on a firm tooth on either side of a line of fracture, and connected by a fracture bar (Fig. 6).

Fig. 7 shows a heavy wire bow anchored by wire ligatures close to the teeth of the larger fragment, with traction on the smaller fragment tending to pull it into proper position. This traction is continuous either through the spring of the bow alone, or is assisted by using rubber or silk ligatures on the teeth of the misplaced frag-

ment. If the fragments can be brought immediately into position, a simple wire bow or an expansion arch is ligated to appropriate teeth. This is sufficient for certain cases where the fracture is at or in front of the first molar, but, even here, greater stability is obtained by fastening a bow to each dental arch and then ligating the

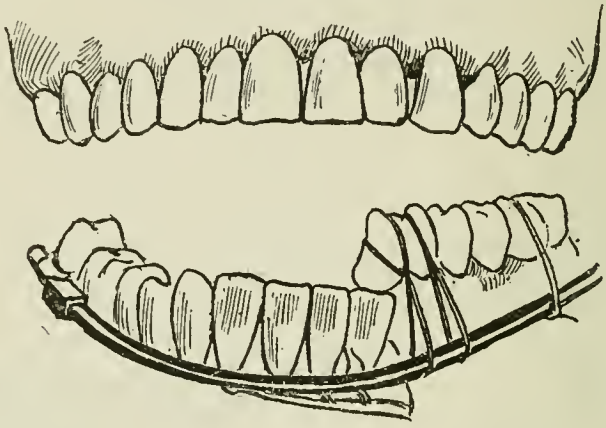


Fig. 14.

upper to the lower bow (Fig. 8). This latter procedure will control not only fractures in the anterior part of the dental arch but also fractures of the angle or ramus. Small hooks may be attached to the bows in appropriate places for more conveniently ligating them together or to procure traction of an elastic band (Figs. 9, 10, 11).

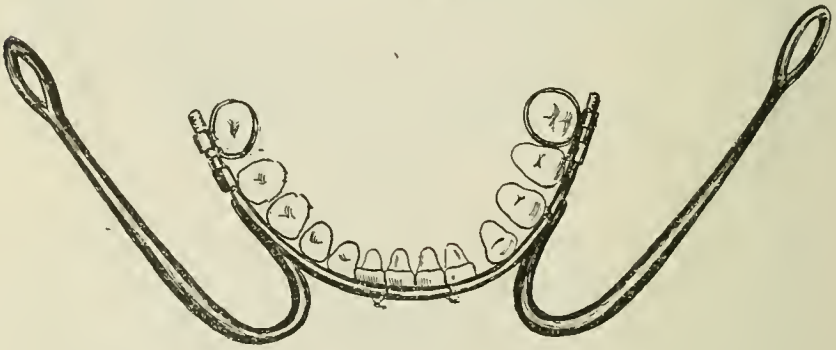


Fig. 15.

If it is desired to allow movement of the lower jaw at the mandibular joint, flanges or interlocking lugs may be attached to the bows (Figs. 9 and 11).

Where there are no teeth in a smaller posterior fragment, a loop may be made in this end of the bow, which may be covered with

modeling composition or vulcanite, so as to rest on or saddle the edentulous fragment (Fig. 12).

Where there is a gap in the continuity of the body of the mandible behind the last available tooth, the posterior fragment can be controlled by attaching a saddle to the end of the wire bow after the plan of Herpin.

A raised fragment can be lowered to the occlusal plane after the plan shown in Figs. 13 and 14.

A fractured maxilla may be supported from a head cap by fastening to an upper expansion arch arms similar to those in the Kingsley splint when used for treating fracture of the upper jaw (Fig. 15).

External pressure on some part of the upper jaw may be exerted by pads attached to an upper expansion arch by means of the arms mentioned.

A BATTLEFIFLD HYPODERMIC SYRINGE[1]

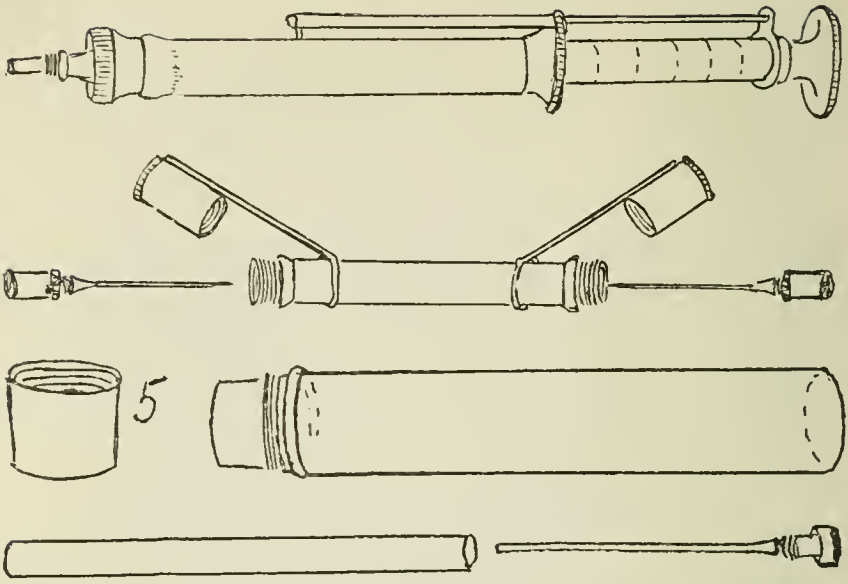
The late Lieut. Colonel William W. Reno, Medical Corps, U. S. Army, whose untimely death has deprived the country of the services of a most loyal, useful, and enthusiastic medical officer, wrote THE MILITARY SURGEON, shortly before leaving for France, of hypodermic medication and his own apparatus, so well known in the Army, as follows.—EDITOR.

The hypodermic syringe case, as usually manufactured, is incomplete in that the essentials of a hypodermic injection are not contained therein. These essentials are: (1) a syringe and needle, (2) the medicament, (3) water—if the medicament is not already supplied in solution, (4) a spoon or other container in which to mix the medicament and water, (5) matches or other means of sterilizing the spoon, the hypodermic needle and the solution. The syringe also should be sterilized.

Seldom is a hypodermic syringe case seen on the market that supplies more of the essentials of an injection than those marked (1) and (2). (3), (4) and (5) are almost universally absent. Why the medical profession has permitted this condition to exist so long is unknown. When a hypodermic injection is needed, especially at private homes on night calls, or elsewhere where the rapid sterilizing facilities of a hospital are not at hand, if the physician must call for a spoon, some water, matches or other means of sterilization, and excited persons, often not acquainted with the routine of the household, must find them, delay in giving the injection is inevitable and speed is practically always an importane factor. Often an injection so given is open to criticism as to technique, due to vexatious delays in assembling the requisites. This is unfair to the patient, as all delay is easily preventable if the physician would carry a hypodermic case that contains all the essentials for a hypodermic injection.

The hypodermic case here described carries all these essentials, in a container no larger than that ordinarily housing a hypodermic syringe, two needles

[1] With four cuts.



and four tubes of hypodermic tablets. This outfit consists of (1) a flat metal case with two swinging stages, (2) an improved hypodermic syringe with two needles, (3) a needle tube, for holding and sterilizing the needles, (4) a vial, for holding sterile water, (5) a sterile mixing chamber, for dissolving the tablet in the sterile water, (6) a tube, holding a solution for sterilizing the injection site, (7) four tubes of hypodermic tablets. The entire outfit is carried in the usual soft cloth pouch. A detailed description is as follows:

The case is flat and practically the same size as the usual case. It is 3¼ inches long, almost 2 inches wide and ¾ of an inch deep. It contains two swinging stages—one in the lower part of the case and the other in the lid, each attached on a pintle at an opposite end. Each stage has short metal clasps attached to it for holding equipment.

The syringe (2) is an improved all-metal syringe. It consists of a barrel, an adapter, a plunger and stop rod. The barrel is a straight tube with a raised rim at the plunger end for holding purposes and a threaded thimble shrunk on the other end for holding the adapter. It holds 1 cc. when the plunger is fully extended. The barrel end of the adapter is a truncated cone with threads beyond. When these threads are engaged in those in the thimble a water-tight joint instantly results. The needle end of the adapter is a small truncated cone, also threaded. When it engages with the needle a washerless, water-tight joint also is instantly produced. The plunger is a solid cylinder of equal diameter throughout, except at the handle end, where it is reduced and threaded to attach an end-holding piece called the thumb rest. This separation of the thumb rest is necessary in order to admit a collar holding the distal end of the stop rod. The stop rod is a metal pin sliding in a small tube attached to the barrel. This stop rod is merely to prevent pulling the plunger from the barrel

when loading the syringe. The plunger is divided by rings into tenths so that the space between any two rings represents 100 milligrams of solution. Any type of syringe can be used in the battlefield hypodermic case, but the type mentioned is advised because it is compact, unbreakable, and never out of order, if ordinary care is taken, and especially because, even under great pressure, water or other solution cannot be forced past the plunger. The truncated cone adapter affords a liquid-tight joint without washers and ease in cleaning the barrel.

The needle tube is a small metal tube about 2½ inches long with a milled metal screw-cap at each end held to the body, when unscrewed, by wire rods. This tube is just large enough to admit a needle at each end. When inserted, the needles project one-eighth of an inch for easy removal. The caps make liquid-tight joints. The needles are kept in this tube when not in use. The tube is filled with a 10 per cent solution of caustic soda, which prevents rust and sterilizes the needles.

The water vial is a heavy, annealed glass vial which holds 8½ cc. of sterile water, enough for eight injections.

The mixing chamber is merely the cap of the water vial. It fits to the water vial with a liquid-tight joint. The solution to be injected is mixed in it.

The injection-site tube is a small liquid-tight tube holding 10 per cent caustic soda or other solution for sterilizing the site of the hypodermic injection.

The four tubes of hypodermic tablets are of those drugs most desired by the user of the outfit.

At a suitable time the apparatus should be sterilized, the vial filled with sterile water, the 10 per cent caustic soda solution placed in the needle and injection site tubes and the desired tubes of hypodermic tablets added. The outfit is now ready for eight sterile injections. Even more can be given if additional sterile water is added, when needed, and care in technique is used.

To use the appliances, remove the water vial cap and fill it half full of sterile water from the water vial. Put the tablet desired therein. Remove a needle from the needle tube, being careful to touch the base of the needle only. Attach needle to syringe, mix medicament, and draw solution into syringe. (The mixing can be done more readily with the syringe adapter, before attaching needle, if the needle end of adapter is sterile.) Apply sterilizing fluid to injection site. Inject.

With the outfit herein described a sterile hypodermic injection can be given in a fraction of the time usually taken. On the battlefield, or at the first aid station, a soldier needing a hypodermic injection is entitled to a sterile one, if needless delay is not caused thereby. His vitality is already, presumably, reduced, so why take a chance of reducing it further by an unsterile hypodermic injection. The outfit described eliminates needless delay. If an unsterile injection must be given, the battlefield hypodermic apparatus provides water and other essentials for the injection, thereby saving valuable time. Even though morphine solution is carried into the field, the usual hypodermic outfit is badly handicapped as soon as the morphine solution is exhausted. With the battlefield hypodermic syringe the morphine solution can be used until exhausted, then morphine tablets used. Also any other medicament can be used at any time as readily as morphine solution.

CORRESPONDENCE

MOTHER-WIT IN WAR SURGERY

A letter recently received from a Medical Reserve Corps officer in France contains material of such interest as to warrant the publication of the following excerpts.—EDITOR.

In the first place I find that surgeons are somewhat in doubt and confusion regarding the whole question of the chlorine antiseptics. No one can believe in dichloramine who does not believe in the Carrel treatment, and no one can believe in any of the chlorine compounds who does not believe that Labarraque's solution was a good solution. Perhaps you will pardon me if I express my views on this subject and find it necessary to carry you back over what is undoubtedly to you a well-trodden pathway. Early in the war, the question of wound antisepsis arose and Lorraine Smith and Dakin, working independently of each other, came to the conclusion that chlorine was the most beneficial of the agents which they had tried. They then proceeded to study Labarraque's solution and found that this old, clinically proven antiseptic suffered from a chemical fault. It was alkaline, becoming increasingly alkaline as the chlorine was set free, and burned the normal skin. They each corrected this chemical fault by chemical means, namely, the addition of buffer salts; and these watery solutions, with chlorine as the active agent, achieved a great place for themselves and are probably in most general use today. Now, these aqueous solutions suffer from another chemical fault which surgeons do not understand and will not learn. This fault is that the chlorine is given off explosively, so that within ten minutes after dressing the wound with Eusol or Dakin's hyper-chlorite solution, no more free chlorine can be detected.

It is manifest that this chemical fault can be corrected in either of two ways, mechanically, *i. e.*, by adding the solution as often as necessary, or chemically, by putting it under such chemical conditions that the chlorine will be given off slowly as needed. Carrel undertook the mechanical correction and undoubtedly succeeded, but surgeons refuse to understand that in the Carrel method you must use either constant instillation, or intermittent, at periods of not over two hours. Even today one will see surgeons putting on a wet Eusol dressing and sending patients on a 36-hour trip to England with no opportunity for a change of dressing. That these cases arrive violently septic should not surprise one, and they do it every day.

Dakin has been working to overcome this chemical fault by chemical means. His first effort was to find out the active antiseptic agent, and his work lead to the conclusion that it is not the free chlorine but the combination which is effected between the chlorine and the nitrogen

of the tissues in other words, chloramine. So he endeavored to obtain a solution of chloramine, and the first result of this was "chloramine—T," an excellent antiseptic; but it suffers also from the fact that it is too explosive or, in other words, does not have the necessary depot action. The chemical fault of effervescence is not yet corrected. His further efforts gave us "dichloramine—T" which is only soluable to any amount in the essential oils (hence eucalyptol as a solvent), and then, to prevent the chlorine from being given off too rapidly, he added paraffin oil which acts chemically as a reservoir from which the chlorine is given off over a long period. This solution suffers from the fault of chemical instability, making it necessary to ship the remedy in three separate packages which, in these circumstances, constitutes a difficult problem, because the base depots did not recognize the importance of keeping the three together. In consequence we hear of dichloramine having been tried and found wanting, because some tried it in water in which it did not dissolve very well, and some applied the dry crystals, they having received only one constituent of the triune group. So Dakin has been working to find a solvent and chemical protector in one, and this he calls chlorcosane. The surgical world seeing this strange word and jumping to the conclusion that it must be something new, puts it into the category with acriflavine, brilliant green, mercurophen and other new things of which the surgeon says he has tried enough; he will stick to that which he knows. Yet dichloramine—T and chlorcosane, after all are nothing but Labarraque's solution refined, concentrated and purified and absolutely nothing new surgically.

The question of wound treatment is becoming more and more hopeless. The fundamental difficulty is that surgeons are not talking about the same thing. They fail to distinguish between wounds,—between early infections, fully developed infections and late infections. Yet it is certain that the whole question of asepsis or antisepsis, and even perhaps the choice of the antiseptic, will depend upon the nature of the wound and especially upon the stage of the infection. We hear now constantly the statement that it makes no difference whether there are any bacteria in the wound or not, it can be closed just the same, meaning secondary suture. If they would only qualify this statement and say that an early wound, within 12 hours at the most, before there is any extensive growth of bacteria, can be closed without an antiseptic, if mechanically cleansed, even though there are undoubtedly some bacteria left, well and good; but when they apply this thought to wounds that develop sepsis and lymphangitis (and all infections are a lymphangitis, whether in the tissues or the joint cavities, the belly cavity or the chest, the organisms are always in the lymph spaces, unless it be that they have gotten into the blood stream, in which case the patient has passed from the hands of the surgeon into the hands of God) when they apply this thought to the kind of wounds we get here, 36 to 48 hours behind the lines, they are talking foolishness. Now they may say, these leaders,

that they mean of course the first class of wounds only, but they are not saying so; and as leaders and teachers they should know by this time that their remarks will be taken literally. If it makes no difference whether there are bacteria in the wound or not, then we might just as well go back to the days when we stropped our scalpel on our bootleg. I presume we would get away with 80 per cent of the cases even then.

I hear constantly that the French are excising, sewing up immediately and curing 80 per cent of the cases; but I have not heard a single person yet who apparently has wondered what they are getting in the other 20 per cent. When you stop to think that from 40 to 60 per cent of our cases here, depending upon the nature of the convoys, are returned to convalescent camp, that is, are healed in three weeks time at the most, then this French record does not look quite so wonderful, especially when you consider further that the French are more successful than any other of the belligerents in saving their men and are probably therefore, though I have no statistics, more successful in that they have a larger proportion of slightly wounded men. These slightly wounded men are of the greater military importance, since the saving of time lost in hospital is equivalent to an increase of man power; but they are not the cases which possess the greater surgical interest nor from which lessons concerning wound treatment must be drawn.

Again, one hears that all the antiseptics should be thrown into the sea. I cannot comprehend such a sweeping statement, for there will be a considerable number of cases in which free excision cannot be carried out because of anatomical considerations. A case in point is the following: A patient came to us with, among other wounds, a wound of the thigh. The C. C. S. note said a piece of shrapnel had lodged against the femoral vessels but had not injured them. The patient died and autopsy revealed a septic thrombus of the femoral vein at the site of the wound, with pyemia, etc. Complete primary excision was manifestly impossible, except hip joint amputation. There was no antiseptic available, apparently (perhaps they had all been thrown into the sea). Yet to my tottering reason such a case would be better with an antiseptic than without.

Your specific questions are hard for me to answer because we are in a base hospital and do not see a great deal of the work in question. My personal opinion is that there is no great demand for the highest type of brain surgeon. Like every other branch of the surgery of war, one does his best with what has been left, and the man of good general surgical training will or should do as well as the highly trained specialist sometimes perhaps better. How many head cases are encountered I do not know. From what I know of general physiology, I suspect that the greater number of men hit in the brain excite only a certain theological interest. The question of transfusion is no nearer settled than it ever has been. As best I can learn, they do transfusions and some cases recover and some die, just as with salt solution.

The treatment of shock is just exactly where it always has been with the little ray of hope that some good men are at work upon it. It is certainly not true that shock is due to acidosis. A little thought ought to convince anyone of any experience that this cannot be so, because the most severe acidosis he ever encountered clinically—namely, in diabetis—never produced symptoms of shock. That acidosis is present is almost to be expected because the failure of the circulation results in a failure on the part of the lung to properly oxygenate the blood. A necessary and natural increase of the CO_2 content and therefore, again naturally and logically, a diminution of the alkali reserve; and also the sodium bicarbonate infusions do no more good in practice than anything else. I should say that, as always, common sense and trust in God still remain the best treatment of shock.

The more I see of this game the more it seems to me that what is needed is not the training of a specialist but the training of the good, old-fashiond, common-sense general surgeon. Just think for a moment that on several occasions here our old friend, ———, the neurologist, has had to turn to and dress wounds. He and I have both been glad under the circumstances, that we had dichloramine. The only difficulty with the Carrel method here is that it simply cannot be done. Suppose your reservoir is frozen solid during the night, how can you keep up continuous irrigation?

THE MEDICAL CORPS OF THE ARMY

Medical Officers Training Camp,
Camp Greenleaf, Ga.,
March 16, 1918.

Dear Editor:

An editorial in The Military Surgeon this month ably presents a plea to eliminate the "R" from the M. R. C. and the "N. G." from the M. C., N. G., so that we shall have only one Medical Corps in the United States Army.

This is one of the most constructive suggestions that has ever appeared in The Military Surgeon, and is the first step in closing a foolish line of cleavage in a profession that has never yet united, and which must be united if we are to accomplish our destiny.

We look beyond "the war," which, great as it is, in the sense of world history, is but a flare-up that has made us momentarily concentrate into a spectacular demonstration. The real war did not begin in 1914, not will it end in 1918; it began when the cerebrum of man began to bud, and will end when the millenium arrives. The real war is a struggle for humanity. Of all men the medical man is most humane, so, of all men, this battle is the doctor's battle. We have today united to show that we can unite, for service, for country, for humanity, and, to consolidate our union, we must ruthlessly destroy any such lines of

cleavage as the "R" in M. R. C. and the "N. G." in the M. C., N. G. small rifts now, but likely to become greater.

No fight was ever won by jealous or suspicious groups of men, and there should be no jealousy or suspicion in the new medical profession, particularly in the military services, in which one must be for all and all for one—our country.

In today's mail we received a letter from Europe which was a wail of discontent. The ugly accusation appeared that the regular officer looked down upon the reservist who, to quote the writer, had no chance. Now we have a very high opinion of the regular corps—a most exalted opinion—and we do not believe that our correspondent had a shred of evidence to prove his contention. We do not believe that the Medical Corps has ever produced a jackass, idiotic enought to assume professional superiority over the Reserve Corps man. Every regular we have ever talked to upon the subject, is thrilled with admiration for the patriotic stand of the great volunteer of the world, and we all have taken him into our ranks as a beloved and revered brother, who honors us by associating with us, learning from us that which we can teach and giving unto us abundantly of his great store of knowledge. Had the "R" or the "N. G." been eliminated from our correspondent's collar, the misunderstanding would have been eliminated from his heart. Cut out the "R." and the "N. G." There can be but one Medical Corps in America—the corps that has severed all diplomatic relations with inhumanity.

I have often wondered if your readers ever asked themselves what a united medical profession could do? If not, I pray that they will sit down, dream, and then arise up to battle that the dream may come true.

Very truly yours,

HENRY PAGE,
Colonel, M. C., U. S. A.

To THE MILITARY SURGEON.

CAMP SHELBY, MISS.,
March 16, 1918.

THE EDITOR,
THE MILITARY SURGEON.

DEAR SIR: I am glad to note among your editorials in the current issue one on the Owen bill. We of the Guard have always thought of this bill as one that left the Guard out in the cold and I was pleased to observe that it might be we were included. I am writing to ask that you give me any additional information. Yesterday's papers carried a news item to the effect that the Surgeon General had been before some committee speaking in favor of the measure. Can you tell us if it has been changed to include the medical officers of the National Guard as well?

Very respectfully,

A. G. CHITTICK,
Major, M. C. N. G., U. S.

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THE
MILITARY SURGEON

VOL. XLII JUNE, 1918 NUMBER 6

ORIGINAL ARTICLES

Authors alone are responsible for the opinions expressed in their contributions

THE TREATMENT OF TUBERCULOSIS

BY COLONEL G. E. BUSHNELL, *U. S. A., Retired*

IF AN animal of experiment, a guinea-pig or rabbit, is inoculated with a large dose of virulent tubercle bacilli the result is inevitably death within a few weeks or months. It matters not what treatment is employed; no amount of rest or fresh air is of any avail, and liberal feeding can only slightly prolong life.

Why, then, it may be asked, is there reason to hope for benefit from such inadequate helps as fresh air, rest and food in the tuberculosis of man?

The answer is, that the animal has never been in contact with tuberculosis and has had no opportunity to acquire the heightened resistance as the result of such contact which we call immunity. The young child or the uncivilized adult who receives large or, what amounts to the same thing, frequently repeated doses of tuberculous poison without having had any previous experience with tubercle bacilli dies as certainly and speedily of tuberculosis as the animal of experiment. Animals, including man, differ as to their susceptibility to different strains of the tubercle bacillus and to the tubercle bacillus in general, but, given a sufficient primary dose of tubercle bacilli virulent for the species, the result is always the same—death in a few weeks or months, provided that this dose is really the first one received. Moreover, the form of the disease is an acute generalized tuberculosis which bears little resemblance to the pulmonary tuberculosis with which we are familiar.

But animal experimentation has abundantly shown that if an animal is given a small amount of tubercle bacilli as an initial dose, and if sufficient time elapses between doses, when a second and much larger dose is given the result obtained is very different. The animal either experiences no ill effects whatever from the second dose or is very slightly affected by it in comparison with the deadly

effect from the large primary dose, the results varying somewhat with the species and to some extent with the individual. There can be no question that these facts are applicable to the tuberculosis of man, that the reason why our patients do not die, as a rule, of acute tuberculosis, but have a chronic and limited form of the disease, is because they have had small immunizing doses of tubercle bacilli and have acquired a certain immunity. A non-resistant animal which receives an intravenous injection of pneumococci does not die of pneumonia but of pneumococcus septicemia. A certain amount of resistance is demanded in order to localize the disease as pneumonia. Just so the non-resistant animal dies of generalized tuberculosis after a large dose of tuberculosis, and only the relatively immune animal acquires tuberculosis limited to the lungs. But pulmonary tuberculosis, as it usually presents itself, manifests a tendency to cure or at least a tendency to become localized, so many years of conflict are required in many cases, before it succeeds in having its own way with the patient, that there can be no doubt that an immunity is present and that it is an immunity of a very high degree.

Supposing now that the patient has this high degree of immunity, that there has been only a slight lapse from the state of absolute immunity, it is reasonable to believe that comparatively slight remedial agents, a little improvement in the conditions of life, a little rest, somewhat better and more abundant food and the like, may suffice to assist the patient's organism to make the comparatively slight effort demanded to acquire again the state of absolute resistance to the tubercle bacillus.

What we seek by our treatment is not to find agents that shall destroy or inhibit the tubercle bacillus, as much as to help our patients to restore their own immunity. Countless drugs have been useless, or worse than useless, in combating tuberculosis because they have been employed with a false idea. They have been selected with a view to destroy the tubercle bacillus, or to cure some symptom such as cough, not with a view to strengthening the resistance of the patient, of restoring his immunity. It may be doubted whether any drug will ever be found that will have any material effect in impairing the activities of the tubercle bacillus, but it is quite easy to name numerous drugs which will have an injurious effect upon the patient.

In the present state of our knowledge it may be laid down as an axiom that anything that is bad for the general health of the patient is bad in the long run for his tuberculosis. On the other hand, the making of antibodies against the tubercle bacillus is a function of

the nutritive activities of the cells of the body. Hence anything that favors a more perfect nutrition is of benefit in helping to regain the lost immunity. The agents that have been found to be helpful in this regard are better oxygenation from abundance of pure air, rest to restore the weakened nerves of the patient and lower demands upon his reparative powers, and good food well assimilated. These constitute the tripod of treatment; with them wisely used wonders can sometimes be accomplished, but only, it should always be borne in mind, in cases in which there already exists an immunity which is capable of reinforcement. Some patients get well, in spite of gross neglect of treatment, others are only cured by much careful treatment; still others die with tuberculosis which advances inexorably from the very outset, no matter what treatment we may adopt, the result in the individual case depending fundamentally upon the degree of immunity which the organism is capable of attaining.

In tuberculosis we prescribe not medicine, but a mode of life. It is a simple matter to write prescriptions; it is difficult to work upon the patient's mind so effectively that he will be willing to change entirely his mode of living and to persevere in the new way for months, perhaps for years, often through his whole life. To do this requires much patience and zeal. The physician must have faith in the treatment that he prescribes; he must really believe what he says when he strives to influence the patient. You can deceive a patient for a little while, but he will detect shams in daily intercourse which extends over months. The physician then must have the zeal of a missionary seeking converts. He must also have a knowledge of the reasons why certain things are necessary in treatment and be able to present these reasons so convincingly as to persuade the patient to receive them and be guided by them. Thirdly, the physician must have skill in diagnosis to determine the exact condition of the patient so that therapeutic measures, like exercise, rest and feeding, may be so prescribed as accurately to meet the patient's varying needs.

The psychical side of treatment is that which is most neglected, yet in it the most notable successes are attained. Some physicians expect their patients to be morally weak, to demand amusement, to need diversion, to be unable to exist without the presence of their families, and they excuse harmful exercise on the ground that otherwise the patient will become despondent. No good results are ever attained in that way. Others consider it necessary to keep up the patient's faith in treatment by the use of drugs, which are given

as placebos, not because they are of therapeutic value. And they will tell you that as the course of the disease is long it will be necessary to frequently change the drugs employed, in order that the patient's hope may be kept alive. This also is a device of the faint-hearted and the pessimistic. They are trying to deceive their patients and must inevitably fail in the long run. The patients may not indeed believe that they are being deceived, but they will infallibly lose faith in the efficacy of the medication.

The physician with faith and zeal will endeavor to bring the patient's will to assume command. He will encourage optimism and perseverance, a resolute putting away of doubts and fears, a stout-hearted determination to endure cheerfully a monotonous existence.

The patient, to be a successful patient, must himself have a good deal of the philosopher in his make-up. The writer's experience leads him to believe that fully two-thirds of the patients can be successfully influenced psychically. Intelligence in the patient is much to be desired, but not all intelligent patients can be influenced. Next to a good immunity and a good physician the third most important desideratum in the treatment is faith in the physician and willingness to coöperate on the part of the patient.

REST

The influence of rest in abating the severity of an inflammatory process is well known. Especially important in tuberculosis is rest with a view to lessen the volume of the pulmonary lymph. The effect of motion and of friction in spreading infection from a suppurating focus is a familiar surgical fact. As Tendeloo has pointed out, it is probable that extensions of tuberculosis in the lungs are caused in a similar way. The diseased portion of the lung, having lost some of its elasticity, expands less than the neighboring healthy portions and at the same time contains a greater amount of fluid; hence the possibility of the suction of lymph, presumably contaminated with tubercle bacilli and their poisons, from the focus into the healthy lung through the numerous anastomosing lymph channels. The danger of such extensions will naturally be greater the more acute the inflammations, and consequently the larger the volume of lymph, and the more vigorous the respiratory movements. In other words, with relative rest of the parts the neighboring healthy lung will not be as likely to aspirate lymph from the tuberculous focus, partly because from the favorable influence of rest there will be less lymph to aspirate, partly because the suction

will be less. From the foregoing it is evident that breathing exercises are contraindicated in the active stage of the tuberculous process. Not only should deep breathing be avoided, but motion of the upper extremities should be reduced to a minimum.

Rest is also highly desirable to promote cicatrization and encapsulation. Surgeons have discovered that the formation of fibrous tissue in wounds is greater when the parts are at rest than when they are in motion. So far as the lungs are concerned, the process may be explained as follows: Tendeloo has shown that a chemical irritant injected into the normal lung excites zones of inflammation the nature of which varies with the concentration of the irritant, there being a central necrosis, then fibrinous, then serous inflammation, and last of all a zone of proliferation of fibrous tissue. Similarly in tuberculosis the formation of fibrous tissue is caused by irritation from the poisons of the disease. Now there must be an optimum amount of irritation which will excite the growth of fibrous tissue to the greatest possible extent. The parts being at rest and the irritant being supposed to be produced as a constant quantity, the influence of the irritant will be most apparent at the distance at which the optimum stimulus is excited by it; connective tissue may perhaps be formed within and beyond that zone, but the efficient encapsulation will take place at the optimum distance. If the parts are in motion, the irritant, instead of exerting its stimulant effect over a certain limited zone, will be diffused, now one and now another part of the tissues being flooded by it, but there being nowhere a zone in which the optimal stimulation is steadily applied. The result of this will be a wider diffusion of less well developed fibrous tissue, so that, while there may be in the aggregate a larger fibrous transformation, its effectiveness as a capsule will be impaired directly as the extent of its diffusion.

Lastly, rest of the body is needed for its recuperation. In fighting its mortal enemy the body has two tasks; first, to make anti-bodies against the tubercle bacillus; second, to erect fortifications in the shape of encapsulations. Both tasks have to be performed by an organism below par. Perfect nutrition is required for the complete success of the undertakings, especially for the more difficult problem of furnishing efficient antibodies, but the nutritive activities have to be exerted by cells more or less poisoned, more or less badly nourished, fed by blood that may be fevered but which, whether fevered or not, is certainly tainted. Evidently, with such tasks before it, the organism cannot afford to waste its strength and substance in making unnecessary repairs, not only in replacing the

cells of voluntary muscles, but much more in making up deficiencies of that mysterious force which we call nervous energy. If anything is certain in the therapeutics of tuberculosis, it is that the most fatal injury that can befall the consumptive is the exhaustion of his nervous energy by over-exertion. We must then guard his scanty store of this most precious possession by every means in our power in order that what remains of it may be used only for the most necessary expenditures.

Rest, as we use the term in the treatment of tuberculosis, means, of course necessarily, only relative rest. There is no doubt—in the mind of the writer at least—that the nearer the patient can approach to a state of absolute rest, if he is more than slightly affected and if the disease is active, the better his chances of cure. An example will serve to show how great an improvement may be made by apparently slight differences in regimen. A physician with advanced and extensive pulmonary lesions, and with a maximum temperature oscillating about 102° and 103° F., was accustomed to dress every day, go downstairs and spend the greater part of the daylight hours sitting quietly outdoors. When the writer assumed charge of the case he at once directed that the patient go to bed. To this the patient strenuously objected, saying that he would get weak in bed, would lose appetite, that he was not taking any exercise, etc. However, he finally went to bed with reasonably good grace. Very soon improvement in his condition became manifest, his temperature gradually dropped to normal and remained there, and the evidences of activity in his lesion abated and finally disappeared. The patient admitted, after six months in bed, that not only had he not become weak but that his muscles were larger and stronger than they were when he took to his bed. Upon passing from under treatment, the patient returned to the east. Here experts examined his lungs and told him that the disease was arrested. He became over-sanguine, exerted himself too much, and finally died. The case is cited as an evidence not only of the value of nearly absolute rest as a curative agent, but also of the need of long perseverance with the treatment in advanced cases if durable results are to be obtained.

Sitting is an artificial posture which requires the constant contraction of certain groups of muscles. It is therefore not only a form of exercise, but a bad form of exercise. Consequently it is much better for the patient to lie flat on bed or couch when resting. But even in lying certain minutiae must be taken into consideration. Some patients do not know how to rest, even lying down. They are constantly in motion, turning from side to side, restlessly changing

their position, or they constantly busy themselves in reading, writing or talking. For such patients even lying down is exercise, and not the best form of exercise. The full benefit of the recumbent position can only be attained if the patient is taught to practice lying perfectly still with relaxed muscles.

It is unfortunate that the term "relaxation" smacks of dilettanteism in medicine, having been used in the Delsarte method, for the procedure is one of value if thoroughly understood and faithfully practiced. It was pointed out long ago by Charles Darwin,[1] quoting Herbert Spencer, that the nervous energy liberated in mental activity overflows upon the muscles and, if in large amounts, upon the viscera. The mental activity of the subject can be determined in a rough way by inspection of the face, the expression of one in deep thought having a tenseness which is absent in reverie or mental relaxation. Much more evident are the changes in expression when the emotions are excited. It is very easy to see that the face you watch denotes anger, grief or joy, the tension of the facial musculature varying with the emotion felt. We judge of the nature of the emotion by the action of the small and unimportant facial muscles which are but little controlled by the will, but the overflow is not limited to these groups. The infant expresses his joy by waving his arms and kicking his legs. As he grows older he learns by degrees to repress emotional display in the voluntary muscles which are well under his control, but more or less tension still exists. Furthermore, the viscera also are specifically affected by the varying emotions. Stimulation of the tear gland, with its unimportant secretion of salt water discharged outside the body, furnishes a safe means of minimizing the repercussion of emotion upon the viscera. The sthenic emotions raise the blood-pressure and strengthen the heart action; the depressing emotions have the opposite effect. Anger is injurious to the liver; nervousness causes a polyuria; fear strengthens peristalsis with resulting diarrhea or even vomiting. The relation of the emotions to the genital organs is also a conspicuous illustration of nervous overflow.

The converse of the above proposition—namely, that the absence of tension of the muscles has a tendency to quiet the emotions and to inhibit the general activity of the brain as an organ of thought—is not so easily proved, but seems to be shown by experience to be true. There is no better means of securing sleep than to relax completely all the voluntary muscles. The method is as follows: Assume a comfortable position with the body so placed that it is in a state

[1] "Expression of the Emotions, in Man and Animals," 1873.

of stable equilibrium; that is to say, is not maintained in its position by muscular effort, the arms and legs being likewise so disposed that muscular relaxation will not change their positions. These precautions will prevent the "startings" or reflex contractions which so often disturb the body which is relaxing in its first sleep. Then give the attention to the relaxing of any muscles that are in a state of contraction, devoting especial attention to the muscles of the neck.

Very often it will be found that the position thought to be one of rest has only been maintained by the contraction of groups of muscles, which when they relax cause the nose to plunge into the pillow or otherwise necessitate a change of position. The best way to relax the muscles is to expire deeply, letting the muscles go during the process, "hitting the bed hard" as the saying is, then holding the position gained in the following inspiration. There is an analogy here with the method of exploring the abdomen by pressure during expiration which is obvious. The classical position for relaxation is supine at full length with arms and legs everted, the stronger flexors thus being stretched to their full length, the weaker extensors being less likely to maintain involuntary contractions, but the principle in either position is of course the same. This procedure will seem to many a trifle unworthy of consideration, but nothing is a trifle which will exert a favorable influence, to however slight a degree, through weeks and months, and it is precisely the failure to take advantage of the seemingly little helps which makes the difference between success and failure in the treatment of tuberculosis. The patient having learned to relax for a few minutes—and it is useless to expect more at first—is encouraged to gradually increase the length of the time during which relaxation is obtained, being charged to seek perfect relaxation for a comparatively short time rather than to practice it carelessly for a longer period. Having learned the art, it is best to require him to devote to it certain periods of the day, preferably before meals, for as long a time as it can be endured without becoming burdensome.

Patients differ much as to their success. Some succeed almost too well, so that they drop to sleep at every opportunity; others taking it up half-heartedly never really acquire the method. But the relaxing of the muscles is only the beginning of the schooling of the patient. He must be taught likewise to control his emotions. The influence of worry, homesickness and other depressing emotions upon the nutrition is a familiar fact. The patient must be instructed to put away resolutely such depressing thoughts, at first during periods of relaxation, later at all times. To such counsel the obvious

retort is: "I know that I am sick, miss my friends, etc., and it is useless to pretend the contrary." This is true, but the proper answer here is: "It does not matter what you know, so long as you do not allow it to excite your emotions. Your stomach does not care what you *know;* it is only disturbed when you *feel.*" The idea that it is the emotional reaction to unpleasant ideas that is injurious, not their intellectual apprehension, is one more easily imparted to the intelligent patient than might be supposed at first sight. For those who do not readily yield their consent to this psychical training it is well to suggest that, if they must worry and feel "blue," that they select certain hours of the day as "worrying hours" in which they may feel as despondent as they please. The suggestion rarely fails to excite a smile, and it is quite evident that an emotion deliberately excited at a fixed hour will rarely be strong enough to be prejudicial.

It is well also to incite the patient to suggest to himself sensations of comfort and well-being, especially during the periods of relaxation. We physicians are far too prone to neglect the influence of unfavorable suggestions upon the well-being of our patients. The fact of sickness, one's presence in a sanatorium, physical examinations, discussion of symptoms, etc., are so many suggestions of an unfavorable kind. It is our duty to train our patients to feel that their salvation lies in securing a preponderance of favorable suggestions, that here again, though one really does not feel well, yet if he can hoodwink his viscera into the idea that he does, he is accomplishing something worth while. Just as the intellectual apprehension of the fact of illness does no harm when divorced from the emotional reaction of the same unpleasant fact, so a more or less feigned sense of well-being does good though the intellect perceives its falsity; moreover, the feigning of a sense of well-being is the best way to realize a genuine sensation of the same kind.

The tuberculosis patient is neurasthenic; that is, he has a weakened nervous system. Wundt long ago showed that if the sciatic nerve of the frog's leg is stimulated by an electric current, the effect of the stimulation of the fresh nerve is to produce, first, an inhibition of contraction, but with continued action, a contraction of the muscle. When the nerve has become exhausted by repeated stimulation, the inhibition is absent and the first effect of the current is contraction. In other words, excessive irritability of the nerve is a sign of nervous exhaustion.

Similarly the nervous system shows its weakness by a too ready yielding to emotion, a too rapid response to stimulation, a tendency

to expend energy to the impoverishment of its store. Hence it is said that neurasthenics have anesthesia of fatigue. A stimulus that would remain unnoticed by the healthy sets the nervous "on edge." A healthy man has no tendency to expend energy except for adequate reasons; the exhausted nervous system expends energy with extravagance on slight or no provocation. The restlessness of the sick is felt as well by the overfatigued. They are "too tired to rest." So the neurasthenic keeps up his activities to the point of exhaustion, and often prides himself upon an activity of body and mind which is overdrawing his capital. A patient will often claim with pride that he has a too active mind because unable to quiet his brain, though its activity is employed to no useful purpose. He may also be too "active" in his own estimation to need bodily rest.

When a patient, after working beyond his strength, or at the end of long journeyings, is at last put to bed, the nervous excitement which has kept him up abates and he begins to realize his true condition of weakness. He sometimes misinterprets this and believes that rest in bed, instead of revealing his weakness, is causing it. Not uncommonly he will demand to be allowed to leave his bed, declaring that he is growing weaker every day and will soon die unless he gets up. No time should be lost in explaining to the patient the need of rest and the reason why he has not apprehended that need. Complete rest with the relaxation of the muscles is an imperative indication; the patient must learn at the earliest moment what his weakness really is, and, as it were, build up strength from a solid foundation. Having recreated in some measure his energy, the next problem is to persuade him to store it up. The over-irritability of the nervous system does not disappear in a day. The patient is impelled to expend his minimal quantity of energy as soon as it is created; whereas he much needs a bank account, he acts like the child who must spend his penny as soon as he receives it. The patient most difficult to control is he who has not experienced an exhaustion, the existence of which could not be denied. The thoroughly exhausted patient does not forget his experiences and is taught by them to appreciate considerations like the foregoing. But the patient who is simply "nervous" and restless requires much patient endeavor to bring him to a realization of his need of absolute rest. In fact, the best thing that could befall him would be an accident like a fracture which demands long rest without any question.

The history of a patient of the writer will best illustrate the fact that conditions which call for unusually prolonged rest often operate

to the ultimate great advantage of the patient. A naval officer, 58 years of age, had a rather large and active tuberculous lesion, involving the right upper lobe. There was sometimes rather high fever, but this abated under rest, and he became able to take some exercise without apparent ill effect, except that cough and positive sputum persisted. The patient and his family were under the impression that an active life was to be desired, and by rides and walks he fancied that his condition was improved. The probable outcome of the case appeared to be a considerable prolongation of life without absolute arrest of the tuberculosis. But, fortunately for him, a complication, usually regarded as serious, declared itself. His activities began to be impeded by pains which he ascribed to rheumatism and treated ineffectually in various ways. Finally the severity of the pain drove him to consult the writer, who at that time had not been in direct charge of the case. It then appeared at once that he had the classical signs of Potts disease with a well-marked "knuckle" over a dorsal vertebra. The prominence of the protrusion, the severity of the pain, and, above all, the fact that when attempt was made to apply a cast the pain shifted from one to the other side of the body, led to the diagnosis of such a breaking down of the vertebra that the spinal cord was in danger of compression. The attempt to use a cast was therefore abandoned and the patient was put to bed on his back. There he remained, without once turning on his side, for seven months. At the end of this long period, when he finally arose, his spine was soundly healed and the disease of his lungs was completely arrested. This happened twelve years ago. The patient is still on duty, and in excellent health. There can be no doubt that the spinal complication was the most fortunate event that could have befallen him as far as the cure of the pulmonary condition was concerned.

The treatment of tuberculosis as thus outlined is not an easy treatment. It is well therefore to train the patient from the outset to feel that he has a responsibility for the outcome, that he must learn to exercise control over his nervous system, that the treatment involves a discipline which is not easy to acquire. The following case illustrates what may sometimes be accomplished with an intelligent and docile patient. An officer of the army arrived at Fort Bayard upon a litter, after a long journey, in such a state of exhaustion that death appeared imminent; in fact his mother was at once sent for to be with him at the last, and stimulation was resorted to in the hope of keeping him alive until she could arrive.

The case was one of acute involvement of the entire right lung. There was an enormous cavity, and the fever was high; in short, the case was one that seemed inevitably destined to death. The patient requesting a prognosis, he was told that he was very ill and that no promise of recovery could be given, but that there were certain things that he could do to help himself and that they were worth trying. The psychical treatment was thereupon explained to him. He grasped the idea quickly and devoted himself to its realization with his whole soul. The result was that his mother, who came to see him die, remained at his bedside for two years. When he was finally able to leave his bed no one who saw the rosy face and well-rounded limbs of the patient would have dreamed that he had lost practically the whole of his right lung. He is still living after twelve years, is married and at last accounts was in good health. If the skeptic doubts the connection between the brilliant outcome and the method of treatment, the writer can only rejoin that he has never seen so ill a patient recover, nor has he ever known a patient to carry out so thoroughly and persistently the principles of treatment inculcated.

The thought of spending endless days in bed, without occupation, is terrifying at first. But it is surprising how quickly the docile patient learns to adapt himself to the situation if the issue is squarely presented to him at the outset. The psychical training gives him occupation and in favorable cases the manifest benefit therefrom encourages perseverance. It helps greatly to have a schedule of work for the day, so many minutes or hours for muscular relaxation, succeeded by reading, or listening to reading, perhaps writing letters, the care of the toilet, etc., then another period of relaxation, and so on, but always with the idea that the rest is the serious work of the day, its interruption the less frequent, and prolonged periods of amusement. So the patient soon learns to spend his days in a kind of busy idleness which makes them seem not long. Much depends upon the persistence and robustness of view of the physician. If the latter indulges in an injudicious sympathy, tries to amuse the patient, teaches him to depend on outside helps instead of upon himself, not much will be accomplished. In short, the patient must be made to feel that the physician really believes in what he teaches. The patient must be taught the necessity of not interrupting the treatment on any excuse. The tubercle bacillus has no "days off;" he must therefore take none himself. Rest must by all means associated with the outdoor life so far as is practicable.

FRESH AIR

Fresh air is perhaps as important a factor for the cure as rest, in the long run, but the difference between the air of a well-aired room and the outer air is not great enough to justify loss of rest or the endurance of discomfort in order to obtain the latter. A very ill patient is not strong enough to endure the vicissitudes of the outdoor life and does better in his room with windows raised. A stronger patient will profit by sleeping out of doors the whole, or the greater part, of the year; but no patient should be permitted to defy the storms and thus run the risk of becoming wet and chilled. A certain amount of hardening is advisable. Covering should be rather light than heavy. Warmth which leads to perspiration is always bad. For the same reason, hot-water bottles should be used sparingly and for brief periods, and so-called chest-protectors should be eschewed altogether. As in the case of rest, it is important that the patient should feel that the physician is in earnest in his advocacy of fresh air. This he will not believe if he finds that he is permitted to stay in ill-ventilated rooms or even sit behind the stove in a room filled with tobacco smoke. Strictness of discipline in this regard is of much importance.

EXERCISE

The febrile tuberculous patient in whom the maximum daily temperature exceeds 99.5° F. should unquestionably be kept in bed. As the temperature falls, the patient may be allowed to attend to his own toilet, perhaps shave himself, or walk about for a few minutes. Such relaxation of the regimen should occur immediately after eating, in order to take advantage of movement as a stimulation to peristalsis. It is better to permit alternations at first only between lying in bed and walking or standing than to allow much time to be spent in the sitting posture even without walking. These indulgences should be carefully specified, their duration prescribed, and increase in length made very gradually under control of the temperature by repeated thermometric observations. The question as to the importance and significance of minor fluctuations in temperature is a most difficult one to decide. The temperature of a normal man who is left in bed continuously for weeks shows fluctuations of a fraction of a degree from very slight causes, as interesting studies have demonstrated. In these studies the temperature of normal men at work was also taken, night and morning, during a month, with the result that temperatures above 99° to 99.2°, 99.3°, even 99.5°, were not uncommon in the evenings. The temperature

which, taken before breakfast after a night's rest, was perhaps 97.8°, after half an hour's work habitually rose about one degree. The members of the group studied in this way four years ago have all remained well. The fluctuations of temperature, while perhaps not, strictly speaking, an entirely normal phenomenon, were at least not evidence of a masked tuberculosis.

It is therefore unsafe to regard minor fluctuations of this kind an evidence of tuberculosis in doubtful cases without careful regulation of the mode of life. The well man may show considerable fluctuations, but they are developed in the course of an active life with its irregularities as to expenditure of energy and as to amounts and character of food consumed. If, on the other hand, the tuberculous patient is shielded from vicissitudes and leads a regular life, similar changes of temperature may rightly be ascribed as a rule to the tuberculous process *per se*. The problem, however, remains one that will frequently tax the acumen of the physician. The best rule is to require the acute case to rest irrespective of temperature, as the conditions become more chronic to be guided strictly by the thermometer, and when the case has become one that is progressing toward arrest to ignore the slighter fluctuations of the temperature. Cases with large lesions must be treated with more severity as respects the enforcement of quietude than those with small lesions. All of which goes to show the absolute necessity of an accurate diagnosis of the patient's condition in every respect if one is to gauge with correctness the indications for rest or exercise, and, if the latter is permitted, its amount.

Each case must be the subject of special study. No hard and fast rules as to fluctuations nor as to thermometer readings which permit exercise can be laid down. In case of doubt it is always safer to err on the side of too much rest. Exercise as a therapeutic measure should be restricted to the chronic case, and the physician should be quite sure that he is able to determine the fact of chronicity before making such prescriptions. The writer has sometimes had occasion to reproach himself for undue leniency in permitting exercise prematurely. The error most frequently made is to allow the amount of exercise to be too rapidly increased and to fail to insist upon adequate control of the effects of exercise by the thermometer. As has been well said, the patient who begins to exercise has reached a period of danger in his course of treatment. He can hardly be too carefully watched. In the southwest are the graves of many consumptives who have been told to "rough it and keep away from doctors."

FEEDING

The patient who has worked beyond his strength has often been too tired to eat for long periods, in some cases has had little and poor food. Put such a patient to bed, with a mind free from care, and give him an abundance of good plain food, and it is surprising how much he can eat and how well he will digest his food, gaining weight rapidly and improving unmistakably in general condition. In a case of this kind, where there is a deficit to make up, the problem of nutrition is easy—all that is necessary is to give the patient what, and as much as, he wants. When cases from the proletariat of large cities are admitted into tuberculosis institutions for comparatively brief periods, a few months at most, the great majority of the patients will belong to the class which is able to eat well and will be benefited by so doing. Hence has arisen the teaching that a patient should be overfed, that hyperalimentation is one of the factors of treatment. So it is, so long as there is a deficit of nourishment to be made up. He who has starved long can feast for a while with impunity.

But if such a patient remains long under treatment, the time will come when he is "filled up," as the saying is. He has made up his deficit, and from that moment he becomes like others with regard to the dangers of surfeit. Many patients have always had an opportunity to rest and an abundance of good food to tempt their appetites. They have no true deficit to make up. For such patients stuffing with food is only prejudicial. In many cases difficulties of digestion are dependent upon the kind rather than the amount of food. Too much of concentrated foodstuffs, acids, sugars, fats and meats, tax a system not stimulated by exercise and produce heaviness, gastric acidity and bad temper. The stomach and intestines of him who lies still all day, if kept over full, become enfeebled in their peristalsis, and dilatations readily occur. The food consumed at one meal should be entirely digested before the next meal. It is a common fault to overfeed from a sense of duty, with no real desire for food. The patient who begins the day with a too ample breakfast often makes that breakfast his only meal. It is often wise to omit a meal or two until a healthy hunger develops. He who is a little ahead of his needs is never hungry; he who does not quite satisfy his appetite always enjoys eating. There is a truth in the saying, "It is better to eat yesterday's dinner than tomorrow's."

In view of the prevalent doctrine of the need of overfeeding in tuberculosis, it may be well to cite a case in which the cure of tuberculosis progressed, though the patient was on what might be called

starvation diet. An officer returned from the Philippines with small tuberculous lesions of both upper lobes. The sputum was positive for tubercle bacilli. In addition to the tuberculosis, he had tropical sprue and had had hookworm. Upon arrival he was unable to take anything for many weeks except small quantities of milk. To this he was finally able to add a small quantity of grapenuts and very gradually to increase his food supply by an occasional egg, a few biscuits, a ripe pear, etc. Notwithstanding the fact that his diet for months was greatly deficient, both in calories and in nitrogen, his tuberculosis progressed most favorably to complete arrest. He finally recovered entirely from the sprue, and has been on duty in the Philippines for six years.

The fact that semi-starvation does not necessarily lead to tuberculosis, as is commonly believed, has been demonstrated on a large scale in the case of the French prisoners. The alarming accounts as to the prevalence of tuberculosis among these unfortunates, which have received universal credence, are now found to have been greatly exaggerated. In certain groups of returning prisoners the percentage of tuberculosis has been rather high, but among large numbers of the repatriated returned of late it is reported to have been surprisingly low.

SYMPTOMATIC TREATMENT

The symptomatic treatment of the consumptive does not differ from that of other patients. Cough medicines should be used sparingly and only for special indications, as, for example, after hemoptysis. Much can be done by teaching the patient to suppress useless cough. The patient who has a cavity should be taught to empty it, at least once a day, by assuming a position that will favor drainage into the bronchi. Some patients have the idea that it is necessary to expel expectoration at the earliest possible moment, and often exhaust themselves by prolonged coughing in order to raise an insignificant pellet of mucus, which, with a little patience, would have been forwarded by the natural mechanisms so as to be readily ejected with little effort. The idea that expectoration is infectious for the patient and must be gotten rid of without delay is one for which the physician is sometimes responsible. A worse error is to inculcate the notion that it is extremely dangerous to swallow sputum. Patients are sometimes kept in a state of nervous apprehension, which is most prejudicial to their recovery, by such injudicious teachings.

The tuberculous patient ascribes all his unpleasant sensations to

the tuberculous process. For him, the pain in the chest which is so common always means pleurisy, and a little diarrhea raises the specter of intestinal tuberculosis. The physician can be of much comfort by teaching that the fugitive pains in various parts of the body, and the various manifestations of indigestion, are common in all those whose health is below par and have no direct connection with tuberculosis. At the same time, such symptoms call for inquiry as to the cause with a view to improving the personal hygiene, and the patient should be encouraged in the ambition so to regulate his life as to have as nearly a perfect digestion and elimination as can be attained under the conditions.

TUBERCULIN

The writer has seen too often very serious harm from tuberculin, as employed by others, to be enthusiastic concerning its use. Tuberculin is most helpful to those who need help least. Advanced cases of tuberculosis are very seriously injured by it, but the rather numerous class of sanatorium patients who have little or no active tuberculosis, their disease being of a chronic, though often diagnosticated as acute, type, are able to tolerate it, sometimes apparently to their advantage. Those physicians whose practice is mostly confined to cases of well-marked, manifest pulmonary tuberculosis are rarely enthusiastic advocates of its use. An accurate diagnosis is indispensable. Tuberculin in the hands of the ignorant is a terribly deadly weapon. The writer believes that cases of genuinely active tuberculosis are more often harmed than benefited by it, and is of the opinion that better results in the long run for the average patient are attained by the psychical treatment. He is therefore opposed to its use in army hospitals.

THE COMBAT AGAINST DISEASE DURING THE WAR[1]

By Colonel CHARLES U. DERCLE, *M. C., French Army*

WAR! It had been said, especially in Germany, that the brutal aggression upon a people entirely devoted to peace, since so little prepared for war, would come to an end in a few months; and, in fact, one might have believed it, seeing the inundation of our frontiers by innumerable multitudes rolling in like waves toward Paris in August and September, 1914.

But this time the genius of the French race watched. He had marked the line where the French were to die rather than to recoil farther. He inspired in the chief who commanded, in the soldier who combated, a soul of victory. And there was the battle of the Marne! Let us render homage to Marshal Joffre, to his officers, and to his soldiers whose authority on the one hand and valor on the other prevailed in this memorable time over menacing barbarism, and in so doing saved the civilization of the world.

The essentials were accomplished, but the war, the source of all evils, was to endure; and at the time in which I speak it is still, no doubt, far from coming to an end. It is interesting for us to inquire what rôle the medical corps has played since the month of August, 1914. Let us say at the outset that the medical corps has been true to its traditions of courage, and, as we shall see later, has striven with all the resources of its art against the so terrible ravages of the engines of war of every kind in use since the commencement of hostilities, as well as against the injurious influences which always spring into being under the difficult conditions of war. The spirit of all those who have the honor to belong to this élite corps has never faltered; all their thoughts have been and still are turned to those who combat; their hearts have always beat for those who suffer; their souls have been with those who fall, and their desires and all their efforts have been directed towards a single goal, to realize for their wounded the good of which they dream. Special mention deserves to be made of the physicians who serve at the front. It is an honor, but a dangerous one.

Yes, they are admirable, these physicians, who go to lift up and care for the wounded through the whistling of the balls, the tumult of the shells, and, what is still worse, among the heart-rending cries

[1] Lecture delivered before the Southern Sociological Congress at Birmingham, Ala., on April 15, 1918.

which at evening rise from the field of battle—cries of anguish and of pain from those who suffer and demand water; cries of distress of the poor little soldier who, dying, calls for his mother. Nevertheless, tranquil and stoical, having for arms only the firm resolve to succor their fellowmen, they go to brave death without the excitement of combat, thinking only of saving their brothers, while around them others can think only of slaying. Their devotion is sublime; it is pure as crystal.

Young and old, of whatever rank, they have shown that the physician knows how to die to succor his fellow-men. Do you wish the proof of this? At the end of December, 1914, of our 14,000 medical officers, of whom 6,500 were with the army, 793 were killed, wounded or missing, 93 were killed, 260 were wounded, 440 were missing (this is a proportion of more than one to eight); 507 were removed sick, giving exactly 1,300 in all *hors de combat.* In all the grades of rank was the same courage—14 superior officers, colonels, lieutenant colonels and majors; 79 subaltern officers, captains, first and second lieutenants, have succumbed. Such in the five first months of the war were, I will not say the losses, but the offerings of the medical corps for the liberation of their country. It is a fair page of history that French military medicine has just added to its Golden Book.

Since this epoch, the good reputation of the medical service has not failed; the phalanx of its heroes has increased, distinctions for brilliant service have been numerous. High authority has confirmed their courage, their abnegation, their spirit of sacrifice. Many citations to the order of the day of the army, with bestowal of the war cross, no lesser number of nominations to the Legion of Honor, and awards of the military medal have been made by those who understood their worth. Of them all, one knows not which are most worthy of praise for their courage, their endurance, or their ability.

The great events which have unrolled in the course of these tragic years, and which, when we shall no longer be remembered, will astonish the historian, have not retarded the labor of the medical corps. Besides the hecatombs which an emperor, mad for conquest, has decreed by a stroke of the pen, the great war has multiplied the number of the wounded to unforeseen proportions.

The surgery of war has been active. Surgery of war is peculiar, in that it occupies itself with the wounds of war; that is to say, with wounds produced under such conditions that the application of the rules of common surgery is surrounded with difficulties which too often render it illusory, disappointing, or altogether impossible.

So the true rôle of the military sanitary service consists in rapid and well-ordered evacuations and in the installation of appropriate surgical centers so as to approach as closely as possible to the conditions of normal surgery. This rôle is fulfilled today. The wounded who can be moved are directed quickly and well to hospitals provided with a sufficient equipment and with competent surgeons surrounded by trained assistants.

The terrible spectacle which we had under our eyes after the Battle of the Marne has brutally awakened us from our dreams!

We expected that the tincture of iodine and the application of individual dressings would preserve the majority of the wounded from the accidents of infection which carried off so many in the ancient wars. The stern reality quickly opened our eyes, and when we saw large shell wounds the prey to all sorts of contaminations and small wounds which led to the worst accidents of infection, the agreement was made by all unanimous and definitive. We proclaimed the necessity of removing constrictions, of immense incisions, of cleansing as perfectly as possible of the irregular wounds, of the immediate extraction of foreign bodies, of the fragments of clothing, of accessible projectiles.

From the first days of the war the apparition of gaseous gangrene, which many had never seen, alarmed the surgeons. The nature and the treatment of this formidable disease were the object of all their attention.

Depage, our eminent colleague of Brussels, whom the war has doubly afflicted, at once in his heroic country and in his dearest affections, has every confidence in subcutaneous injections of oxygen, which is equally recommended by Vennin. Many employ oxygenated water for lavage and for dressings; Ombredonne and Souligoux, extol ether; Morestin, formol, while the majority use various liquids. But there is one essential point as to which everybody is in accord—the necessity of removing constriction by large and deep incisions at as early a time as possible. Frequently, in the case of massive gangrene, safety is only found in immediate amputation. Michaux and Schwarts even advise cutting constrictions with the actual cautery. These large incisions are, in fact, an heroic therapeusis. Duval has reported a good series of cures, and we all saw, after the battles of the Marne, of Artois, and of Champagne numerous wounded who owed their lives to them.

The question of amputation has always much occupied the surgeons. Should I or should I not amputate?—this is frequently

the dilemma before which the surgical conscience is often placed. As a general principle, a limb which appears too much diseased to be saved, and which is a danger to life, should be sacrificed. It is a matter of tact, experience and judgment on the part of the surgeon. I pass over many subjects, however interesting—frostbite, secondary hemorrhage, aneurisms, wounds of the skull which heal the more surely the more quickly they are explored and the more completely the so common fragments of bone are removed. We have learned that the most superficial wounds are often accompanied by a bursting of the inner table, which compresses and sometimes tears the dura mater. The surgery of the skull should be early and free. It is, moreover, easy and almost harmless so long as the dura mater remains intact, and the wounded are too numerous to count who owe their lives to an immediate and systematic exploration.

Interesting studies have been made on the subject of fracture apparatus. The difficulties which the treatment of open fractures, and particularly fractures of the thigh, present are great. To care well for one of these fractures is without doubt the most difficult task which falls to a surgeon. The large plaster apparatus with iron arms, modified in a thousand ways, is that which seems to have the preference of the great majority.

The surgery of the nerves is interesting to consider. Practice has demonstrated that it has had results—cures. That which should be remembered, and which is of a nature to encourage the hope of curing the sick affected with wounds of the nerves, is the demonstration of Madame Dejerine, who has been kind enough to come, with all the authority which is attached to her reputation, to tell the facts acquired by the attentive study of many wounded observed before and after their operation, namely, that the suture of a completely severed nerve may be followed by a radical cure, much more, of course, relief of its compression by fibrous tissue or of its imprisonment by callus.

The surgery of the thorax offers an important point—that which has to do with foreign bodies in the lungs. Their extraction has been successfully accomplished by the surgeons Mauclàire, Marion and Pierre Duval. But, on the other hand, foreign bodies are perfectly tolerated by the lungs, so that the surgeon's action in such cases is not governed by fixed principles, but follows clinical indications. I could not pass over in silence, apropos of the search for projectiles, that marvelous apparatus, the invention of which is an honor to French science. I speak of the electro-vibrator of Dr.

Bergonie, professor at Bordeaux. I owe it an especial debt of gratitude for, thanks to it, I have been relieved of a large number of shell fragments.

What shall be said of wounds of the abdomen? On examination of the results obtained after intervention, the following conclusion has been reached: The wounded should be submitted to operation who are in good condition, whose wounds are recent, and in whom infection has not yet had time to poison the organism. It is this principle that has led to the necessity of organizing operative centers very near the line of fire, or, better, to perfect the means of transportation so that the wounded can be operated upon at the rear under suitable physical conditions in the first hours after being wounded. This is all-important. And, these physical conditions being fulfilled, if the wounded man is in a state of too profound shock, nothing is to be undertaken before he has been warmed, revived, and put by every means in condition to endure a new shock added to the first one. Without these necessary conditions, in the wounded who are fully infected or are in a state of excessive depression, it is better to abstain from operation. Medicine will save more of them than surgery!

Before leaving the field of surgery, I would like to mention the numerous reparative operations of the surgeon Morestin. Reparative surgery of the face is his distinction. The good results that he has obtained are considerable. Numerous are the mutilated men for whom his skillful hands have made a human face, and among them, without doubt, are some who will perpetuate until the end of the century, among the generations to come after us, the living remembrance at once tragic and glorious of the wounded of the great war!

So much for a general view, rapidly sketched. I would like to give you now an account of some concrete facts relative to the last offensive of the Aisne.

The statistical data which M. Tuffier, the consulting surgeon, gives of the army of operations are of much interest. It is known that our soldiers from the first day had passed beyond the objectives assigned to them. This irresistible assault necessarily brought with it an elevated percentage of severe wounds, and, in fact, while 80 per cent of the wounded could be evacuated immediately, 20 per cent were judged to be nontransportable.

As for the location of the wounds, there were, per 100, 16 of the head, 33 of the lower limbs, 34 of the upper extremities, 4 of the abdomen, 26 of the vertebral column. Twenty per cent had multiple

wounds. Shell fragments were responsible for 72 per cent of the cases. The general mortality was 5.18 per cent of the wounded; gaseous gangrene and tetanus were extremely rare—3 per 1,000 for the first, 5 per 10,000 for the second. The most serious wounds still remain those of the abdomen. Their mortality reaches 61 per cent; that of wounds of the chest only 20 per cent.

The new treatments of wounds have proved their high value. Fifteen days later there remained in the hospitals of the front but 1/43 per cent of the wounded. In short, the surgical results of this offensive are much superior to any as yet registered under like circumstances. This success must be imputed to the better arrangement of the hospitals, to the rapidity of collection and evacuation of the wounded, to the intimate correlation of the surgical services, and to the perfection of the methods of treatment. We are assured, as Tuffier says, that the surgery of the army is at present worthy of those for whom it has to care.

Let us leave the domain of surgery to pass into that of medicine. Wars have always been marked by the rapid development of infectious and contagious maladies, which have frequently caused as many losses or more than those occasioned by the projectiles of war. In the present war, if the number of dead and wounded has been enormous, that of the sick is materially less. One would not have expected at first thought such a result. On the one hand, the assembling of men from all the countries of the world, even from those where epidemics reign; on the other, the method of conducting the war over an infected soil where the soldiers often live in defective hygienic conditions, would have led one to fear the appearance among the troops of deadly maladies. Thanks to the efficacy of the measures so energetically employed, the contest with a great number of diseases has been victorious. Dysentery, typhoid fever, diphtheria and tuberculosis have not reigned as sovereigns as in the past. Dysentery, as well as diphtheria, the disease of the trenches in Argonne, has nowhere severely attacked the troops.

TYPHOID FEVER

The menace of typhoid fever has been overcome by vaccination.

Typhoid fever, which has always been a dangerous menace to armies in the field, can from now on be considered as practically suppressed by prophylactic vaccination. Typhoid has become as rare at the front as smallpox. In modern wars, in the campaigns in Tunis, Madagascar, in the Transvaal, in the Spanish-American War, and in the Balkan wars, typhoid fever claimed as many and often

more victims than battle. In the present war there have been times of anxiety in this regard, especially in the winter of 1914–15 and in the course of the summer of 1915.

The sanitary service found itself taken off its guard, and had little time to occupy itself with anything but the care of the wounded. Also, confidence in typhoid vaccination had not yet been firmly established. There were differences of opinion between various schools, and there were controversies concerning the respective value of different methods of vaccination. In consequence, there was a lack of confidence on the part of the public. Many soldiers who would have subjected themselves to vaccination behind the front postponed their decision while waiting for a formal order.

In February of 1915 vaccinationn on a large scale among the troops at the front was begun, and very soon progressive diminution of typhoid fever became manifest.

From a rate of seven per thousand in December, 1914, and January, 1915, the typhoid sick rate fell rapidly to four and two per thousand. From the beginning of February, 1916, the percentage remained constantly less than one per thousand, and by 1917 the rate dropped successively from 0.1 to 0.06.

As for the mortality, this diminished in such proportions that we were forced to report it by groups of 100,000 men.

After having reached 98 in 1914, it dropped to 0.3 in 1917.

If the morbidity and mortality observed from November, 1914, to January, 1915, had been maintained, and we were to make an estimate based on the total number of 4,000,000 to 5,000,000 men at the front, typhoid fever would have afflicted a million men and claimed 150,000 victims.

To illustrate it still more plainly, if we take as a basis for comparison the official sanitary reports of the French Army in 1911, the last one published, one finds that typhoid fever in the armies at the front is actually almost one-seventh less than it had been previously in times of peace. Death from typhoid has occurred eight and one-half times less frequently than in times of peace.

It is perfectly just to say, therefore, that the danger of typhoid fever has practically disappeared. Antityphoid vaccination has caused the disappearance of this disease to the same degree that Jennerian vaccination has suppressed smallpox.

Identical results have been obtained by all the belligerents, and, indeed, in all the armies of all civilized countries. It is perhaps in Servia that the value of these methods has proved most successful.

The unhappy Serbs in the course of their heroic retreat were

decimated by typhoid and cholera. The horrible sanitary conditions and the poor food seemed to reduce them to a state of susceptibility which led to the universal infection and rapid exhaustion of this valorous army. The Serbs were saved by antityphoid vaccination, which was given them mixed with cholera vaccine according to the method introduced by the Italian Professor Castellani, who had been already well known by his discovery of the organism of sleeping sickness.

These magnificent results tend to show not only the value of the antityphoid vaccine, but also permit us to gauge the importance which may be attributed to the various methods by which it is produced.

Pasteur and his school inoculated only living microbes. About 1888, French biologists, chief among whom one may mention Chantemesse and Widal, began to use dead organisms. The bacteria were killed and thus transformed into a chemical product which was without danger for the body.

It is this last method which was used in the preparation of typhoid vaccines, and the various methods of producing the vaccines depend almost entirely upon difference in the methods used for killing the bacteria. Wright and his English collaborators at first used chloroform, but gave this up; Nickole, of Tunis, used sodium fluoride; Ronques and Senez, of Marseilles, used tincture of iodine; others have tried phenol and lysol, etc.

Professor Vincent, of Val-de-Grace, prefers ether, and Chantemesse and Widal from the beginning recommended sterilization by heat. At first they heated up to 120° C., but now they heat only to 58° C. This process, simple in every case, was adopted from the very beginning by the French Army, and is now used almost everywhere in England, America, Japan, etc. The vaccine of Professor Vincent, which is used in large quantities by our army, is furnished by the laboratory of Val-de-Grace. The Pasteur Institute distributes the heated vaccine.

There is not yet universal agreement concerning the duration of the immunity conferred by the vaccine, and for the sake of safety it is repeated at the end of one year. We are under the impression also that in the Japanese Army it is repeated at intervals of six months for two or three years.

Thanks to the perfection of the methods used, the reaction is rarely painful and does not cause serious consequence except in rare cases and in individuals who are unusually susceptible. In 1915 the Institute of France conferred the Prix Osiris upon Pro-

fessors Chantemesse, Widal and Vincent for their work on typhoid vaccine. The fact that this prize was distributed among the three shows that they were all equally responsible for the magnificent results obtained in our army.

As for tuberculosis, it has been spoken of recently. It has been said that during the first year of the war no less than 86,000 men had been discharged from the army on account of pulmonary tuberculosis, and up to February, 1917, it was estimated that about 170,000 soldiers had been discharged for this cause. Later the Chicago *Tribune* of the 24th of July, 1917, stated that the number of cases of war tuberculosis was rated at 400,000. They were really appalling figures, and no doubt spread much alarm, not only in France, but in allied and friendly countries, and, of course, especially in the United States.

What can we truthfully say as a rejoinder to all that has been spoken and written on this subject? These are the facts, drawn from an official communication made by the Ministry of War in France to the French Senate in the sitting of December 14, 1917. They are quite recent, as you see.

From August 2, 1914, to October 31, 1917—that is, for more than three years in all—89,430 men have been discharged for tuberculosis, a proportion which, in my judgment, is not excessive in an army of millions of men.

There is no doubt that war, with its formidable appeal to physical and moral courage, its material privations, its intense emotion, its food sometimes insufficient or badly cooked, its cold, and so forth, predisposes to the awakening of ancient latent foci practically healed, or that it develops elsewhere new internal foci under the influence of violent physical exertions which stimulate the circulation of blood and of lymph and facilitate the dissemination of germs.

On the other hand, life in the open air, muscular exercise and the strengthening of the character are adjuvants against the effects of infectious germs; also, in many cases, the ancient foci remain latent, and the number of men in whom tuberculosis manifests itself in an active state is less than might have been expected.

This appears from the relatively low figures of discharges for pulmonary tuberculosis referred to above. It should be added that of these there is a large number who have returned tuberculous from captivity. There is nothing strange in that for one who knows the pitiable condition of our compatriot prisoners in Germany. Yes, one can say the true scourge comes from the returned prisoners. Of 10,960 returned soldiers, 920 are tuberculosis, or 9.02 per cent; 996

have pulmonary disease, or 9.22 per cent; and to this must be added those still interned in Switzerland for tuberculosis. Swiss physicians estimate that 30 per cent of our prisoners will come back tuberculous.

Therefore, in warding against this menace the medical corps does not lose a day, not an hour, in creating over all the territory of France dispensaries, houses for treatment and repose, and asylums. We are and shall be ready to receive them worthily, those who have thus doubly suffered for us. We shall receive them as heroes, for they merit it. We shall dry their tears, save their families, and especially cure those who are still curable. Already sanitary hospitals have been created which are true sanatoria.

There are at present thirty-seven of these, including services in function in ordinary hospitals. We counted on November 30, 1917, 6,521 beds. To these can be added twenty-one hospitals, containing 2,360 beds, on the seashore, for surgical tuberculosis. We have at our disposal a total of 8,881 beds. Now, at that date there were free 2,399 beds for medical tuberculosis and 500 beds for surgical tuberculosis.

Have these figures not an eloquence of their own, and do they not show clearly that one must guard against pessimism? We may confidently reassure the anxious mothers of this country, who were naturally much concerned by the rumors which have been circulated about the prevalence of tuberculosis in the French Army, and who have been told that their own sons would be exposed to the tuberculous contagion in France.

They may be sure that in France there is constant attention paid to the sanitary service, in order to procure the best conditions of health for all the troops which are on her soil, to put them into the best shape to gain the final victory, which is certain—which must be.

Another alarm has been spread about the frequency of the venereal diseases in our army. There also I shall give you figures which will contradict all the exaggerated rumors regarding this sort of disease. These are the official figures received in December, 1917, as to the ratio per thousand of these diseases in the French Army. The Army of France and Army of Africa before the war had 90 per 1,000, of which the former had 21 per 1,000, and the latter 69 per 1,000. Since the war these armies had 40 per 1,000, of which the Army of France had 14 per 1,000 and the Army of Africa 26 per 1,000. These are divided as follows: Gonorrhoea, 64 per 1,000; syphilis, 26 per 1,000, before the war; gonorrhoea, 31 per 1,000, since the war; syphilis, 9 per 1,000.

These brilliant results are due to the measures fortunately undertaken by the civil administration in accord with the military medical service. You see by this succinct exposé the part taken by the medical corps in the general struggle. We physicians play a necessary and a beneficent rôle in the immense contest. It is we who preserve for France the infinite number of wounded, who would almost all succumb if it were not for our aid. How many wounded, healed by us, have returned to take their places in the combat! Their number is large enough to form entire armies.

As for those who from the gravity of their wounds will never regain the strength to bear arms—more than a million are in this condition—we strive, and with what success, to give them the strength to take part in the struggle of life! Finally, we endeavor to maintain in good health the troops which defend the soil of France against the invader. Do you wish to know the present strength of the French Army over the health of which we have to watch with care? I have said that about one million have been crippled and put definitely *hors de combat*. A little more than one million have been killed in battle. Notwithstanding this, the French Army is composed as follows: Officers and soldiers mobilized January 1, 1917, not including natives of the colonies and workmen in the war factories, 4,725,000 men, of whom about 3,000,000 are at the front. This is the number. Do you wish to judge the quality? The western front is 755 kilometers in length. The Belgians hold 25 kilometers, the English 165, the French 565. We, then, hold three-quarters of the line. I do not hesitate to say that the people who, after three and a half years of war, occupy the major part of the front, have no cause to fear comparison with any other.

A CONSIDERATION OF THE CAUSES AND PREVENTION OF PRIMARY PNEUMONIAS AND PNEUMONIAS COMPLICATING MEASLES IN THE UNITED STATES ARMY.

By Captain WALLACE A. PRATT,
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DURING my winter's experience in camp and at a military post hospital I have watched with intense interest the cycle of events leading to pneumonia, beginning at sick call and quickly ending in death, which are still occurring in spite of all present measures to prevent.

Laboratory and clinical experience indicates that the pneumonic organisms, while probably of four distinct types, are not of the virulent strains which characterized these organisms during the pneumonia epidemic of 1890; nevertheless, we cannot fail to appreciate in how large proportion of the so-called pneumonias, what a prominent part the streptococcus plays.

One remarks that athletes and men from open-air pursuits have less resistance to infection than the shop or office men, newly in the ranks; the changed conditions, due to living in quarters, working havoc with the outdoor men; whereas the indoor men, long trained to superheated rooms, acquire immunity from throat disturbances due to sudden exposure while going to and from work. One may well ask: Why such a mortality? How to present methods of living in quarters break down the resistance?

The following etiological factors may be considered: (*a*) inefficient bedding, (*b*) improper ventilation, (*c*) superheated rooms

(*a*) I have personally used the regulation army blanket, similar to the one used at the present time by enlisted men and by most officers, and will say that it takes from three to four of them to keep an average man warm, even in a mild climate like the Pacific Coast. Were it not for the poncho or tent shelter-half, which are not issued for the purpose, neither ideal, a larger proportion of men would be ill or suffer greatly. The army blanket as a protector from cold is woefully inefficient. Any old army enlisted man or officer will corroborate this statement. Very frequently no care is taken to see that the mattress, or under-blankets, are sufficiently protective. Our recruits don't grumble, but stoically make the best of the situation. Drawn up in uncomfortable positions and losing much body heat through deficient covering, their rest is incomplete. This loss of rest, either by late retiring or inability to sleep from the

above mentioned causes, would answer for thousands of victims from pneumonia. It would seem that even after arising in the morning with most of the man's system awake, the phagocytes go on sleeping, are off guard, and allow the invading bacteria triumphal entry.

(*b*) Plenty of window space is provided and orders given that they be kept open during sleeping hours, yet a visit to quarters during the night will disclose about 50 per cent of the men with heads under the blankets trying to conserve heat in this injurious manner. It can be stated quite frankly that with two blankets, the average issue, and the windows open as they should be, the men would be very cold indeed. Comfort is indulged, the windows are mostly closed, the cots are close together and the air is contaminated by breathing, together with skin exhalations, which latter comprise, it has been estimated, approximately 25 per cent of the excretory output.

(*c*) During the evening hours, from six to ten o'clock, the large drum stoves are heating briskly. The quarters are more than warm with superheated air, to such an extent that the upper air passages of a large majority of the men are dry. As proof witness the expectorating of yellow mucus at reveille, which is evidence of disorder. Dry or sore throat with cough frequently follows, and through the disordered barriers, the pharyngeal membranes, the tonsils or upper air passages, enter the almost omnipresent organisms, having been often freshly cultured in the oral cavity. The blood, already impoverished by toxic products, fails, and we then have primary infection with lung manifestations following.

During Transportation of Troops on Trains.—It is obvious we cannot, under any conditions, provide the requisite air space on our troop trains. In winter time, however, all the side windows are closed, the upper small windows being regulated sometimes by a porter. The heat is dry steam heat, a very difficult matter to improve.

Looking about, we see from forty to forty-eight men seated, sometimes for several days, with no exercise excepting a short walk to meals. The longer they remain inactive the more poisoned they become, the more impoverished the blood, and the less inclination they display to moving about. In a few days their faces become pale, and when a door opens they shrink from the cool, fresh air because large quantities of their blood stagnate in their legs and abdomens. The blood stream is probably slower under such conditions, and the blood, carrying toxins and not enough nutrition, predisposes those so affected to infection.

As a railway surgeon, I observed that instinct, probably, prompts many, especially those traveling in standard coaches and observation cars, to move about, to get off and walk when possible, while the less fortunate travelers in the second and first-class coaches remain seated within closed windows, growing pale and often huddling together to keep warm. Here the resistance becomes very low and the possibilities for infection most marked.

Early in January last a few hundred men arrived at our post from Hoboken, N. J. Practically nearly every man on arrival was ailing. Being officer of the day I assigned twenty-seven of the number to beds at once, and of this number two died. Most of these had sore throat and cough.

The Interstate Commerce Commission has regulations governing the transportation of live stock, such as unloading once in twenty-four hours with six hours in the yards. I am not aware that any traveling regulations are provided for troop trains. On the other hand, troops frequently remain in coaches for many days.

Pneumonia Complicating Measles.—Patients are at once properly quarantined and put into warm rooms with often the same faulty heating resources as in camp. The "measly" odor is about; so is the idea that the air must be kept warm. Ordinarily, barring complications, measles is so common and comparatively harmless that we have almost bred a contempt for it. We now realize that these patients take up the pneumococci readily, and undoubtedly many other pathogenic organisms, especially the streptococci. These cases portray a septic condition early. Are we furnishing proper measures to combat these germs? I submit we are not.

Hospital beds are nearly 3 feet in height, frequently no bedside tables are present, sputum cups 4 inches square are placed on the floor, especially at night, and the sputum more often than not reaches the floor and later contaminates the air.

Then, again, no prophylaxis for cleansing the mouth is carried out. Witness the blood already infected, the inflamed air passages, the injected eye tissues, the coated tongue, and hear the cough. Here, then, is enemy headquarters.

Mixed infections of the blood are dangerous in nearly all cases. In from twelve to twenty-four hours fresh cultures of bacteria begin and in a few days generations with increased virulence arrive. These outlaws having enjoyed the necessities of life—viz., heat, moisture, and food—with only an infected blood stream to combat them, then pass through the tonsillar or other tissues of the throat and make for a new and mixed infection of the blood, with lung, cardiac and

pleural complications often following. Very frequently patients so affected are very septic and die early in the engorgement stage, or from plain septicemia itself.

Prevention of Pneumonia in Camp.—Besides carrying out the usual sanitary regulations, such as opening all windows at night, I would recommend, and emphasize, some additional measures:

(*a*) That during the winter season late leave for enlisted men be stopped to endeavor to secure adequate rest in bed.

(*b*) That a thicker or differently woven blanket be devised and provided as soon as possible, which by proper tests proves its superior heat-conserving properties, or provide a comforter which with its air spaces affords undoubted protection, being probably as efficient as three blankets. It has been noted that most officers possess one or more of these.

(*c*) If still dependent on the army blanket, instruct all men how to prepare their cots. It would be well to make sure of having a good mattress or straw tick below, reinforced if necessary by newspapers placed beneath the mattress or tick. If necessary to use a poncho or tent shelter-half, see that they are placed between the blankets. In this way heat is conserved and the men get the vitally needed rest.

(*d*) That two thermometers be placed in each quarters at reasonable spaces and strict instructions given that the temperature in artificially heated quarters should never exceed 70° F.

(*e*) All artificially heated barracks or quarters should be provided at once with water pans to be placed over heaters and special men detailed to keep water in them. In this way the air passages will be kept in a more normal moist condition and the almost omnipresent organisms held in subjection.

I recommend that for the small box stove the following: a round tin pan 10 inches in diameter, 3 inches deep, open at the top. For the long drum stove a rectangular tin or galvanized tin pan 2½ feet long, 10 inches wide, and 6 inches deep, with two light metal frames supporting the pan, and attached or resting on the side rods. For the steam or water radiators, the hanging water pan.

It may be stated here that these same measures will be found very effective in preventing tonsilitis and ordinary sore throat.

Prevention of Pneumonias Complicating Measles.—For measles, in addition to symptomatic treatment with quarantine, abundant fresh air, alternating beds, head and feet, early diagnosis of lung complications and the immediate separation of such cases from ordinary measles, I recommend the following measures:

(*a*) Insistence on the cleaning of the teeth four times daily, *i. e.*,

after each meal and at bed time, with brush, plus a paste, powder, or salt solution; that dental floss be used once daily and patients instructed how to use the same; that a mouth gargle, such as Dobell's solution or saturated boric acid solution, be used twice daily after cleaning the teeth in the evening. In this way we attempt to suppress the culture of pneumococci and other bacteria in the oral cavity at least.

(*b*) Two thermometers should be placed in every ward at reasonable spaces. Wards should be heated to 70° F. from breakfast time until all baths are completed, when the temperature should be dropped to 66° F., or below.

(*c*) A small bedside table should be provided for each bed, and on this table should be placed an individual drinking glass, a clinical thermometer, and a separate spoon for the taking of cough mixtures or other medicines. In this manner we may check the careless practice at times of giving medicine from the same spoon to different patients.

(*d*) The use of water pans on all heating apparatus in use.

(*e*) More care to see that all patients in bed are warm, and that those up and about are well clad.

(*f*) That once daily during the afternoon, the anterior nares and throat be sprayed with a mild antiseptic spray, such as liquor antisepticus.

Preventive Measures during Transportation on Trains.—(*a*) That the care of the teeth by each man be imperative four times daily, *i. e.*, after each meal and at bed time.

(*b*) That in each car it also be the duty of a noncommissioned officer or reliable man detailed by him to open windows, three on each side, every hour during the day, for a period of five minutes, and at night all upper windows be opened and heat shut off during sleeping hours.

(*c*) That one thermometer be placed on the wall in the middle of each car about 5 feet from the floor and that it be the duty of a designated noncommissioned officer to see that the temperature never exceeds 68° F.

(*d*) That in each car, every three hours throughout the day, starting from 9.00 a. m. until 8 p. m., groups of men, to include every man, take the aisles for setting up exercises, and especially leg exercises.

(*e*) That at every division point all men should be taken off the train and march briskly as long as changing of engines permits, or for twenty minutes.

(*f*) That at 10 a. m., 4 p. m., and 8 p. m. every man should be required to drink one glass of water.

Conclusion.—In dry climates sudden changes in humidity are not encountered as a rule and people living there are acclimated, nevertheless they are affected by any sudden change in humidity.

Observations go to show that exposure to cold temperatures does not predispose one to pneumonia unless through excessive loss of body heat when resistance is lowered.

Cold air is not necessarily pure air, yet in well-ventilated, cool rooms the blood is better able to take up available oxygen. In view of this fact should we not surround all blood infections with these conditions, especially measles?

Do we not lose sight of the fact that the whole blood stream can become toxic in a remarkably short time, even in an hour? Many of these toxic elements are not eliminated as quickly as they are taken up by the blood. May I cite carbon monoxide (CO), although it is rarely present in the conditions under consideration, yet we may have carbon, hydrogen and sulphur combinations in gaseous states which unite with hemaglobin as readily as the monoxide of carbon.

In barracks at bed time, while healthy active men are undressing after a day of marching or drilling, odors from their bodies abound, and we must not neglect to mention those nauseating emanations from the feet. Under these conditions, with slight disorders in the upper air passages, the often freshly cultured pathogenic germs enter and gain such a profound hold that all therapy seems hopeless.

I have observed the complexion of men living under conditions cited above, at reveille; invariably they are pale, almost to a man. After an hour or two of drilling the color comes back and is generally good towards evening. The night indoors follows, with results that should not happen.

It may be stated that, whether troops are sleeping in barracks, cantonments, or tents, rules requiring open windows, or tent flaps, will only be disregarded unless we first of all make sure the bedding is adequate.

Along with other rational measures the drafting at once of systematic sanitary regulations for troop trains seems imperative.

The adoption of some, if not all, of the above outlined preventive measures would seem feasible, practical, and not costly. Would it be possible to save one hundred or even ten men by such action before next winter passes? I firmly believe so and that it would be well worth our efforts to try.

GUNSHOT FRACTURES OF THE LONG BONES OF THE EXTREMITIES

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(With thirteen illustrations)

(*Concluded from page 518*)

Postural Treatment of Fractures.—The postural treatment of compound fractures must be carried on concurrently with the treatment of infection. In the incomplete fractures it is, of course, simple and merely aims at the fixation of the injured segment to prevent any possibility of completion of the fracture. This is particularly important while undergoing transportation, for it not uncommonly happens that a fissured bone shaft is completely fractured by rough handling. It may also happen accidentally in the hospital. In cases of severe infection, as already stated, it is often impossible to apply efficient apparatus until the swelling and pain have been relieved. Under such conditions, one ignores the position of the bone fragments and merely attempts to hold the limb, preventing pain and providing the state of rest necessary for prompt subsidence of the infection.

The end in view in the postural treatment of complete fractures is a firmly united bone shaft, with a fair degree of alignment and with as little shortening as possible. To attain it two methods of splinting are used: the external, by means of apparatus; and the internal, by means of plates, non-absorbable sutures or bone grafts.

External Apparatus.—The different types of splints evolved during this war for the treatment of long-bone fractures are legion in number. They bear witness to the fact that no method of splinting can be devised so simple and efficient that it will become universally adopted. That method with which one surgeon will obtain excellent results and which he will enthusiastically recommend, when applied by another surgeon may not prove satisfactory. Each surgeon must choose or elaborate for himself the method suited to his peculiarities of technique. Then, again, splints which are quite adaptable to the base hospital will be totally unfit for conditions of transport.

In general, however, all splints must fulfil certain requirements. They must maintain complete immobility of the fractured segment, with fixation of the bone fragments. They must hold the fractured shaft in good alignment. If there is shortening, they must reduce it and maintain the shaft as nearly as possible at its original length. They must allow free access to the wound and permit of easy inspection of the soft

[1] I wish to express thanks to Maj. D. P. Penhallow, M. R. C., and the staff of the hospital, for courtesies extended. All X rays and photos were taken at the hospital.

parts. They must be comfortable and allow as much freedom of movement by the patient as possible. They should not hinder the early treatment of the soft parts, particularly of the uninjured segments of the limb, for the prevention of muscular atrophies, and tendon and joint adhesions. In the splinting of gunshot compound fractures, even more so than of simple fractures, "efficiency" is synonymous with "simplicity." The frequently complicating extensive flesh wounds, with their profuse discharges, make imperative a simple splint. Elaborate splints are more difficult to apply, require more painstaking supervision and are more easily fouled by the wound discharges. They subject the patient to a greater degree of discomfort and offer no better results. In the following description of apparatus, I shall confine myself to my personal preferences with no attempt at a general survey.

The non-infected fractures are the easiest to treat. They are, to all intents and purposes, but simple fractures. The wounds are either quickly crusted, requiring only occasional dry dressings, or are slightly granulating, requiring only boric ointment dressings every third day or so. Absolute immobility is essential for at least two weeks to prevent the development of infection along the track of the missile. As a rule shortening is negligible in forearm and leg, requiring no correction; in the arm or thigh it may be considerable and require reduction.

Forearm.—Non-infected fractures of the forearm, as admitted here, comprise about 15 per cent of all forearm fractures. They have been limited entirely to either radius or ulna. All fractures of both bones have been infected. The treatment is ambulatory. There is no shortening when only one bone is fractured, as the intact bone maintains the proper length. Hence a simple fixation splint is all that is required. I commonly use well-padded anterior and posterior wooden splints, about 2½ inches wide, extending anteriorly from the elbow to the tips of the fingers and posteriorly from elbow to knuckles—firmly attached by adhesive straps. The hand is raised by padding until the wrist is moderately dorsiflexed. A sling, with axillary pad and body swathe for immobilizing the humerus, complete the apparatus. By removing either portion of the wooden splint, wounds on any surface of the forearm can be easily dressed without disturbing the fracture. This type of splint is quickly and easily made and is familiar to all practitioners. In cases where the skin wounds, though superficial and cleanly granulating, are yet extensive enough to require daily dressings, I prefer other splints. If the wound involves the dorsum of the forearm alone, I use the Osgood Penhallow tin splint (Fig. 39) with the wrist only slightly dorsiflexed. If the wound involves the anterior surface, I prefer a fenestrated or light bridged plaster (similar to that in Fig. 40).

In these cases the fenestrated plaster is generally better. In case there were a fracture of both bones with shortening, I should either reduce the shortening by manual traction under anesthesia and maintain it by plaster, or resort to constant traction methods, as will be described later in the infected forearm fractures. Forearm non-infected fractures should remain in apparatus from four to five weeks.

Humerus.—About 21 per cent of our fractured humeri have been non-infected. If there is negligible shortening and the wounds either do not involve the axilla or are healed, I prefer to bind the arm firmly to the body with axillary pad, coaptation splints, sling and body swathe. It is very comfortable, permits of the greatest freedom of movement, and produces good results. If there is an axillary wound requiring dressings, I have found a light plaster most useful, including shoulder, arm and forearm to the wrist and circular about the body, with the arm abducted at about 20 degrees, the forearm flexed at right angles and held across the front of the body. In cases with undue shortening the Osgood-Penhallow splint (Fig. 39) is most useful. It invariably corrects the shortening and holds the humerus in good alignment. Non-infected fractures of the humerus should be left immobilized from four to six weeks.

Femur.—Non-infected fractures of the femur have comprised about 23 per cent of all compound fractures of this bone. There is generally considerable shortening, which must be reduced, either by continuous traction or by traction under anesthesia with maintenance of proper length by a plaster spica. In this climate plasters do not harden quickly; frequently twenty-four to thirty-six hours are required. Therefore we have not been able to use plaster for such cases, as they quickly wrinkle and allow the shortening to recur. I have depended entirely upon traction methods. If the fracture is in the upper third or involves the neck of the femur, I prefer the Jones-abduction frame (Fig. 41). Its action will be described later under infected fractures. If the fracture involves the middle or lower thirds I use traction with suspension (Fig. 42), as described later. There is no objection to the ordinary Buck's extension apparatus except that it does not allow the patient as much freedom of movement as the suspension apparatus. Non-infected fractures of the femur should be left immobilized from eight to twelve weeks.

Leg.—About 16 per cent of our compound leg fractures have been non-infected. The simplest apparatus by far is the plaster from groin to toes, with windows cut out over the wounds. Good alignment and reduction of shortening are easily obtained. Such fractures should be immobilized from six to eight weeks.

Infected Fractures—Forearm.—About 85 per cent of all compound

forearm fractures have been infected. The nature of the apparatus depends upon the position of the flesh wounds and upon the degree of shortening, or in other words, upon whether one or both bones are fractured. With non-perforating wounds of the dorsal aspect or with lateral perforating or non-perforating wounds with no shortening, I prefer either the Osgood-Penhallow splint, with the wrist not so much dorsiflexed as in the accompanying photograph (Fig. 39), or a simple angular wooden splint extending along the inner aspect of the arm and antero-internal aspect of the semi-pronated forearm to the finger-tips. Both give sufficient immobilization and free access to the wound. In the case of extensive lateral wounds, an anterior splint may encroach and prevent the careful cleansing of the skin which is so important in Carrel's treatment. Then I would prefer a wire suspension splint with transverse supporting bands of rubber or elastic cotton (Fig. 43) with slight extension from the hand. The supporting bands are attached by clips and may be removed for dressings without disturbance of the fracture. If it is desirable to get the patient out of bed, a light plaster may be applied, interrupted for a few inches above and below the wound, with the gap bridged over by curving strips of perforated zinc reinforced with plaster (Fig. 40). If the wound perforates antero-posteriorly three splints are used. It is desirable that the anterior wound should close quickly, for in this way the wound track will open upward and, acting as a water-tight receptacle, will retain the solution and be more quickly sterilized. This is quite possible in cases with small anterior wounds. For these I generally use a simple anterior angular wooden splint, applying gauze dressings to the anterior wound and instilling sodium hypochlorite through the upper wound.[10] This may be slung from a Balkan splint, allowing the patient more freedom of movement. If the anterior wound is extensive, I prefer the wire suspension splint just described, which permits of easy access. If one wishes to get the patient out of bed, a bridged plaster may be applied. With fractures of both bones there is generally shortening. If so, more attention must be paid to traction. In such a case the suspension splint would be preferable, with 3 or 4 pounds traction from hand and wrist. In a few days, as the muscles relax, 2 pounds will probably suffice. Infected compound fractures of the forearm must be immobilized from six to nine weeks.

Arm.—Of all compound fractures of the humerus, about 79 per cent are infected. As a rule there is considerable shortening. I prefer to treat such fractures for a few weeks in bed. It is much easier to

[10]Carrel et Dehelly: "Le Traitement des Plaies Infectées," 1917.

apply the Carrel method of sterilization. For bed treatment I have found the wire suspension splint (Fig. 43) most adaptable. It gives free access to wounds in all portions of the arm and permits of constant inspection and massage of the soft parts, and of easy determination of the state of union. It was conceived from ideas derived from the study of Blake's methods of suspension. The traction is applied by straps to the forearm, either of adhesive or of gauze or flannel attached to the skin by Hausner's glue: a preparation made up of resin, 50 parts; alcohol, 50 parts; benzine, 25 parts; and Venetian turpentine, 5 parts. With this splint the inferior wounds are allowed to close if feasible and the instillation is carried out through the superior wounds. With cases which have acquired considerable union, or with fresh cases with small wounds and no severe inflammatory reaction, provided always the wounds do not involve the internal aspect of the arm, I have found the Osgood-Penhallow splint most useful (Fig. 39). By varying the length of the humeral portion of the splint any degree of traction desired can be attained, with good alignment and immobilization of the fragments. It is especially useful as an ambulatory splint. With cases of unhealed wounds of the internal aspect of the arm and moderate union, a light bridged plaster suffices for an ambulatory splint. Compound infected humeral fractures generally require immobilization from eight to nine weeks.

Femur.—About 77 per cent of all compound fractures of the femur have been infected. For fractures of the upper third and neck I prefer the Jones abduction frame (Fig. 41). Not only does it leave the wounds freely exposed, but it provides for the necessary abduction of the thigh and traction. The patient can be moved about, raised or lowered, just as upon a Bradford frame. For fractures of the middle and lower thirds I prefer a wire suspension splint (Fig. 42). It extends from buttock to heel and is bent at the knee to an angle of about 30 degrees. The limb is supported by transverse posterior bands of elastic cotton or rubber, each attached separately by steel clips. If there are posterior wounds, these bands may be removed singly and the wound dressed without disturbing the fracture. Traction, varying from 15 to 25 pounds, is applied to the leg and uninjured portion of the thigh by adhesive straps, or by flannel and gauze strips glued to the skin. If the skin is too tender to withstand the usual amount of traction, or if greater traction is necessary for reduction, it may be applied by means of steel transfixion pins, ranging in diameter from $^1/_8$ to $^1/_4$ inch, passed through the condylar portion of the femur or through the head of the tibia. As treated here, compound infected fractures of the femur have required immobilization for about three months.

Leg.—About 84 per cent of all compound fractures of the leg have been infected. For cases with anterior wounds, with negligible shortening and fair alignment, I have found the Cabot posterior wire splint most useful. This may be suspended from a Balkan frame, allowing the patient the greatest freedom of movement (Fig. 45). With similar fractures, but with wounds of the posterior aspect of the limb, the same splint is useful if the posterior support is made of perforated zinc or aluminium with a window cut out at the site of the wound. In those fractures with undue shortening or displacement of fragments traction is necessary. The wire suspension splint just described is very useful. Wounds of any surface are easily dressed. The traction is provided by strips adherent to the lower third or incorporated into a light plaster which fits closely the foot and ankle. If the wound is very low, traction may be applied by steel transfixion pins passed either through the os calcis or immediately behind it and anterior to the attachment of the tendo Achillis. In cases where good alignment cannot be attained by traction, or where it is deemed advisable to get the patient out of bed, a bridged plaster may be applied (Fig. 47). Infected fractures of the leg usually require from eight to ten weeks immobilization.

The various types of apparatus have been described from the viewpoint of base hospital treatment. Some of them would be quite useless for treatment under transport conditions. As regards transport apparatus, I can speak only from my own experience with it as seen on admission here. Forearm fractures are generally admitted with simple angular wooden splints, extending from upper humerus to hand. They are quite comfortable as a rule. Fractures of the humerus, if slight, arrive upon internal angular wooden splints (Fig. 46, [5]); if severe, in modified Thomas extension splints (Fig. 46, [2]). Fractured femurs generally arrive in Thomas extension splints (Fig. 46, [1]). Fractured legs are admitted with simple posterior wooden splints with foot piece at right angles (Fig. 46, [4]). As a rule these splints are quite sufficient, assuring a considerable degree of comfort to the patient while being transported. Plasters are never admitted upon recently wounded cases, and rightly so. I believe it extremely unwise to apply plasters to cases in the pre-inflammatory or inflammatory stage, as they prevent satisfactory inspection of the conditions of the soft tissues. Even with suppurating wounds, they should be applied only if the case is under constant surveillance.

Internal splints.—These comprise bone-plates, non-absorbable sutures and bone-grafts. The plating of infected compound fractures, advocated by a few, has been generally frowned upon. It is as yet a debatable

measure. It was tried in the early months of the war and such poor results obtained that opinion became very much averse to it.

Up to the present there have been four surgeons who professed to have had good results with it. Lake,[11] writing in July, 1915, stated that in a wide experience of infected compound fractures, bone-plating had given the best ultimate results of all methods of splinting. He cites four cases, which seem inconclusive in that the time required for union, the duration of treatment and the ultimate functional results are not stated. Pennell,[12] writing three months later, advocated the method, stating that he had operated upon a fair number of compound fractures and that, of the cases that he had been able to follow he had had "no cause to regret the rather radical treatment of open reduction." He reported five cases of plating. In all of them union occurred early, with good alignment. In two, good function resulted; in the other three it is not stated. The period required for the wounds to heal, the duration of treatment and the final disposal of the patient are not stated. Penhallow,[13] writing in August, 1916, stated that he had plated fifteen cases, with no failures and with excellent functional results. The techniques of these three surgeons are similar, consisting of the mechanical cleansing of the wound and swabbing with iodine or carbolic acid; the treatment of the screw holes with carbolic; the application of a rather long plate; the suturing of the wound with drainage in cases only mildly infected, leaving the wound open and packing down to the bone in cases of severer infection.

Morison[14] has recently stated that with the use of his paste good results have been obtained from plating compound fractures. His technique differs from that just described only in the careful application of the antiseptic paste to all surfaces of the wound and screw holes.

Leriche,[15] after emphasizing the disastrous results which attended the operation in the early months of the war, states that he would not hesitate to plate a compound fracture provided the bone focus were well cleaned, loose fragments removed, all recesses obliterated and the whole wound left open. He insists upon a constant supervision of the patient and that the operation should be done only in the period immediately following the injury, presumably before acute infection has developed. He admits that he has never yet plated gunshot fractures.

On the other hand, the method has been condemned, or at least

[11] Lake: *British Medical Journal*, July 10, 1915.
[12] Pennell: *Lancet*, October 9, 1915.
[13] Penhallow: "Military Surgery," 1916.
[14] Morrison: *Lancet*, August 12, 1916.
[15] Leriche: "Taitement des Fractures," 1917.

declared of doubtful value, by many of the foremost British surgeons. Groves[16] writes as follows:

> I see no reason to retract anything which I have already published as to the dangers of operations performed upon gunshot fractures in their early acute stage of infection. Any open operation must mean large incisions and multiple drillings of the bone. That they have been followed by wide necrosis requiring amputation has been demonstrated. And thus far no one has brought forward any consecutive series of cases proving the contrary. If infection is absent, or when it has been cured, the matter stands just where it did for the closed fractures of civil life. But I am bound to say that the experience of the last two years has very strongly convinced me that a careful study and practice of accurately applied extension methods leaves very little scope for open operations.

Jones[17] has expressed his belief that operative methods for immobilizing the fractured ends are fraught with danger and should be abandoned. Sheild,[18] recognizing the danger of bone trouble about the screws, wrote in December, 1916, that "the latest opinion of the distinguished originator of this practice seems to incline to waiting until a certain amount of union has occurred and sepsis has largely disappeared . . ." Turner[19] expresses his doubt as to the value of the method, maintaining that "it will take a good deal of evidence to show that internal splinting is to be accepted as a principle in the treatment of gunshot injuries."

The main objections to the plating of infected compound fractures, as set forth by those opposed to it, are as follows: that by the incisions necessary for exposing the bone shaft fresh tissues are laid open to infection; that through the screw holes new foci of osteomyelitis develop, with the usual sequelae of sequestration and chronic sinus formation; that because of this additional necrosis convalescence is prolonged; that the plate tends to loosen before sufficient union has developed to hold the fragments in alignment; that even if the plate does not loosen, it acts as a foreign body, prolonging suppuration and delaying union. The opponents insist that there are very few fractures which cannot be properly reduced and held by apparatus, with as good functional results as could be possible; that if a fracture cannot be properly reduced, no operative procedures should be attempted until the infection has been cured.

On the other hand, those advocating the method deny these assertions, declaring that any fresh infection of the soft tissues which may be induced is negligible; that there is no evidence of increased bone necrosis; that convalescence is not prolonged; that if the plates loosen, it is not

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[16] Groves: *British Medical Journal*, July 15, 1916.
[17] Jones: *Ibid.*, January 15, 1916.
[18] Sheild: *Ibid.*, December 16, 1916.
[19] Turner: *Ibid.*, March 18, 1916.

until three to four weeks have elapsed, when sufficient union has developed to hold the fragments in apposition; that plates may be tolerated and incorporated by the tissues in the presence of infection, just as are large numbers of lodged infected missiles; that if chronic suppuration results, the plate is easily removed, having already served its purpose; and that union is not delayed. In addition, they claim for the method the following advantages: that the pain caused by the transport and manipulation of fractures treated by external splints is entirely avoided; that the alignment of the fragments and the ultimate functional results are better; that the dressings are much facilitated; and that massage and joint motions can be carried out much more easily.

Of course the issue rests between methods, on the one hand, established and conservative; on the other, unusual and radical. On the latter rests the burden of proof. The justification of the plating of infected fractures depends upon the fulfillment of certain requirements as compared with the known results of the conservative method, and the final criterion is that of ultimate function and the duration of treatment. The aim of any method of treatment is primarily to procure the best possible functional result and secondarily to procure it in the shortest possible time. Thus it follows that the end results of bone-plating must be at least as good as those of the conservative method. Under no circumstances would one resort to it if they were worse, even if the period of convalescence were shortened or if patient and surgeon would be saved from much inconvenience. If the ultimate function were no better than with conservative methods and the period of treatment were equally long, one would not resort to the method unless it were proved to require less care during the course of treatment or to offer relief from pain and greater ease of dressing and massage. Finally, if the end results were better, the method would justify itself even though the duration of treatment were greater. It would be justifiable also if it produced equally good results in a shorter period.

The controversy presents, on the one hand, assertions favoring the method—and as yet they are but assertions, not proved by any published series of cases—and, on the other hand, objections based partly upon actual bad results and partly upon logical deductions as to the probable results of plating. The one factor which creates prejudice against the method is the presence of sepsis. It is logical to predict that the exposure of fresh bone will lead to additional necrosis with its train of evils. Given satisfactory proof that this does not happen, or given a technique which will control the infection, preventing its extension to the exposed marrow, the objections to the method will cease. As already stated, not enough cases of plating by the ordinary technique have been published to disprove an increase in bone necrosis.

Personally, I have never plated an infected compound fracture. I have treated no fracture in which I thought it justifiable. Given a fracture which presented what to my mind are the two indications for plating—namely, inability to maintain the fragments in proper alignment by external splints or the causation of excessive pain by the frequent manipulation of apparatus which the more complicated fractures often require—I should feel justified in plating it after a thorough application of Morison's paste. I should feel certain that the infection would be controlled. The older technique I would not adopt. It is folly to presume that one application of iodine or carbolic will either subdue infection or prevent its extension. The method offers no other means of controlling it. Even if the wound were left wide open, and the most efficacious method of sterilization begun, it would be impossible to reach the infection beneath the plate and in the screw holes.

Non-absorbable sutures, either metal or animal, are open to similar criticisms, though of lesser degree in that the drilling of the bone would be much less extensive. I believe that they could be used with impunity if safeguarded by Morison's paste.

As regards bone-grafts, the only indication for their use is in cases of pseudoarthrosis, resulting either from the non-union of adjacent fragments or from the presence of a gap in the bone shaft, due to the blowing away of a section by a high velocity missile or to removal of fragments for necrosis. No fracture should be grafted in the presence of sepsis. Although, with a mild infection, the graft may be tolerated and osteogenesis may be even stimulated, yet in severe infections the graft will as a rule loosen and become extruded. From the danger of latent infection it is not safe to graft bone until three months have elapsed after the healing of the wound, unless a two-stage operation is done: first exposing the fracture, cutting the slots in either fragment and treating the wound with Dakin's solution; then, as soon as sterilization is assured, inserting and fastening the graft and closing the wound. At this hospital, Albee's technique and apparatus have been employed with good results, using autogenous grafts from the tibia.

COMPLICATIONS

Muscle and Tendon Adhesions.—The treatment of muscles and tendons, with a view to preventing adhesions and contractures, is by no means the least important element in the care of compound fractures. To their improper treatment may be attributed many of the poor end results. The aim is to keep them supple and free so that they may quickly resume their activity when voluntary movements become permissible.

With certain types of injury, this is not possible. Muscles are at times so extensively injured that large portions of them necrose, and the remainder becomes so firmly adherent to surrounding structures that function is impossible. Such a muscle presents a rather hopeless problem. Operative procedures to free it are useless. If an important muscle of for earmor anterior leg, tendon transplantation may remedy the defect. But if in the arm, thigh or calf, stiffness of the distal joints will result, and the chief problem will be to prevent contractures.

In the less severe wounds, treatment of the muscles, tendons and joints may be most beneficial. It should not be undertaken until sepsis is well subdued, generally not until a fortnight has elapsed. It divides itself into the massage and electrical stimulation of muscle bellies and movements of tendons and joints, not only of the injured segment of the limb but of those uninjured segments which are forced to inactivity by the apparatus. Thus the absorption of the extravasated blood in the injured muscle is hastened, preventing the excess scar tissue which would otherwise develop. Adhesions of tendons and joints are also prevented.

The nature of the treatment, and the period at which it will begin, depend upon the site of fracture and the quickness with which infection is controlled and bony union begins. In forearm fractures daily massage and electrical stimulation of the forearm muscles may begin in two to three weeks, with movements of the fingers and shoulder joint and massage of the arm muscles. In about four to five weeks union will be moderately firm, and careful movements of the wrist and elbow and rotation of the forearm may be begun. The treatment gradually becomes more vigorous until active motions are possible. With arm fractures primary treatment will comprise massage and stimulation of the arm muscles and active movements of fingers and wrist. In about five weeks gentle motions of elbow and shoulder joints may begin, with rotation of the forearm. In thigh fractures the primary treatment will consist of massage of the thigh muscles and active motions of foot and toes. In about six to eight weeks passive movements of knee and hip may begin. In leg fractures, massage and stimulation of leg and thigh muscles with passive motions of the hip joint and toes will begin first, and in about five to six weeks passive movements of knee and ankle joints.

Occasionally, in the larger muscles, adhesions will form in spite of treatment which limit flexion or extension of a portion of the limb, particularly of forearm and leg. In the majority of these cases function will be restored by the use of a Turner apparatus (Figs. 50, 51), which by gradual screw-traction stretches the adhesions. If this is unavailing, operation may succeed, consisting of cutting the adhesions and interposing a layer of fat.

Nerve Injuries.—These are frequent complications of fractures, especially of those of the humerus. They are either immediate, caused by the missile or propelled bone fragments, or remote, developing some weeks after injury.

The immediate lesions consist of complete and incomplete divisions, contusions and concussions. The symptoms of complete division are familiar—namely, immediate loss of sensation and paralyses, with subsequent development of the reaction of degeneration, muscular atrophy and trophic skin lesions. The symptoms of incomplete divisions differ according to the degree of injury. They generally lose the epicritic sensibility, often the protopathic; and develop partial paralysis and atrophies. The contusions result from direct trauma of the nerve trunk with destruction of some of the fibers, or from force transmitted through the overlying tissues resulting in hemorrhage into the sheath. The most severe cases may amount to complete crushes with symptoms of complete division. The less severe cases may temporarily show complete loss of conductivity, but tend to recover function either completely or partially, dependent upon the number of nerve fibres actually destroyed or upon the degree of scar formation resulting from the extravasation of blood. Cases of concussion may present symptoms of complete or incomplete division, but they tend to disappear rapidly.

The remote lesion consists of compression. It may result from inclusion of the nerve trunk in excessive callus formation or from the development and subsequent contraction of scar tissue in the soft parts. Occasionally counter-incisions or wounds pass so closely by nerve trunks that they are caught in the resulting scar. Symptoms begin several weeks after injury, inaugurated by burning pain, and may progress until they resemble those of complete division.

No treatment for nerve injuries should be undertaken until ten days have elapsed. It takes that time for the reaction of degeneration to develop. Moreover, the sensory and motor disorders due to concussion will have vanished, making possible a more accurate diagnosis of the lesion. Treatment may then begin. The most essential requirement is that all paralyzed muscles should be kept in a relaxed condition until function returns. Under no circumstances should they be allowed to stretch, for organic changes might take place in the muscle fibers which would prolong or make impossible the resumption of contractility. This necessity will often prevent the free movements of the tendons and joints which one would desire. Massage and electric stimulation of the paralyzed muscles should be carried out daily. If the position and condition of the wound permit, massage and ionization should be done daily at the site of the nerve injury, in the hope of hastening the absorp-

tion of blood extravasated into the inter-fibrillar spaces and preventing the scar formation which would result from its organization.

Further treatment of severe lesions involves operative interference and does not concern this discussion, except in the case of compression from callus or scar. These cases should be operated as soon as possible and the nerve trunk released and placed in a new sheath.

With regard to compression by scar tissue, resulting from ill-placed incisions, the following case is of interest:

Pvt. T. M., 5th S. Lancashire Regt.; perforating shell wound of left arm at Guillemont, August 13, 1916. Fracture lower third humerus. Infected. Two operations in France for drainage. Admitted A. W. W. II., August 19, 1916. Wound of entry external, 3 inches above condyle. Wound of exit internal, 2 inches up. Two postero-internal surgical incisions. All wounds infected. August 26—Removal necrotic bone. October 20—Wounds practically healed. Elbow joint moves about five degrees. Union firm. Ulnar paralysis developing. Nerve apparently caught in scar tissue. January 11—Paralysis had steadily progressed and atrophy beginning. Burning pains over area of ulnar distribution. Incision over course of nerve. It was found imbedded in the scar tissue resulting from one of the surgical incisions. Released and placed in new fascial sheath. January 30—Sensation of pain and touch partially recovered. February 10—Slight improvement in paralysis. February 22—Transferred to special hospital.

Pseudo-Arthrosis.—This has complicated about 7.2 per cent of all compound fractures of the long bones. Some of the cases have been simple examples of non-union between fragments near enough ordinarily to unite. Others have been due to excessive loss of bone substance through the propulsive effects of high-velocity missiles. A few, on the other hand, have been due to indiscriminate removal of bone fragments at operation.

The treatment of pseudo-arthrosis depends upon the condition of the fracture. If the fragments are closely applied to each other, curettage of the ends with immobilization by a bone-plate or plaster may result in union. In other cases, where there is visible callus formation without stiffening, the injection of blood into the callus may result in firm union. If these methods fail, or if there is an extensive gap in the shaft which the callus cannot bridge, the only method is to insert an autogenous bone graft.

Secondary Hemorrhage.—This has been an occasional, but not frequent, complication of compound fractures in this hospital. It arises invariably from arterial source and in infected wounds. The only proper treatment is to operate at once, secure and tie the bleeding vessel near the point of rupture. Suture of the lacerated wall is rarely possible on account of infection. It is not wise to pack the wound in the hopes of checking the hemorrhage. It may do so temporarily, but bleeding

is almost bound to recur with further exsanguination of the patient. Moreover, by blocking the wound outlet serious infection of the soft tissues may result. I have seen a severe gas infection develop from this cause, in a secondary hemorrhage from the popliteal artery. Proximal ligation, in cases with hemorrhage from main trunks, is inadvisable, in that it may cut off invaluable collateral circulation.

The following case will give an idea of the tendency for secondary hemorrhages to recur and of the complications which may arise:

Pvt. A. M., 6th Dorsets; wounded January 6 by shrapnel bullet entering upper anterior leg passing between tibia and fibula, with incomplete fracture of former; lodging in calf. Wound infected. Incision and drainage with removal of shrapnel, January 8. Three subsequent operations in France for hemorrhage from anterior tibial artery. Admitted A. W. W. H., February 4, with a 6-inch incised, infected wound of calf. February 10—Slight oozing of blood. Granulations had occluded depths of wound. February 12—Oozing began again. Calf became swollen and painful. Pulse rose to 140, general condition poor. Wound explored under ether. Large mass of clot evacuated. Bleeding found to come from popliteal artery. Latter ligated. Hot foments and Dakin's solution applied. Ten hours later the leg had become cold, the skin purple and yellowish-green with bleb formation; subcutaneous crepitation, and a foul and bubbling wound discharge. R. B. C. 2,040,000 (Figs. 53, 54). The patient was transfused by means of Kimpton's tubes—20 ounces of blood. Spinal anesthesia. Amputated through mid-thigh. The tissues, when cut, exuded a lymph-like fluid with bubbles. Flaps loosely applied to each other and tubes inserted for instillation of sodium hypochlorite. February 14—Marked improvement in general condition. No extension of gaseous cellulitis. March 30—Stump healed. Patient up on crutches. April 20—Transferred to Rochampton for artificial limb. Stump healed, solid, painless.

In conclusion a few statistics of fractures treated here may be of interest. Among 4,000 cases there have been 550 fractures, of which 287 or 52.18 per cent have involved the long bones of the extremities. These have been distributed as follows: Humerus, 25 per cent; tibia, 21.9 per cent; ulna, 15.6 per cent; fibula, 15.3 per cent; radius, 12.5 per cent; femur, 9.4 per cent. About 13 per cent of these have been simple fractures, distributed as follows: leg, 53.3 per cent; forearm, 23.3 per cent; arm, 20 per cent; femur, 3.3 per cent. Of 195 compound gunshot fractures the distribution has been: humerus, 31.7 per cent; ulna, 16.4 per cent; femur, 15.3 per cent; tibia, 12.3 per cent; radius, 10.2 per cent; fibula, 4.6 per cent; both bones of leg, 5.1 per cent; both bones of forearm, 4.1 per cent; or as regards segments of the extremities, arm, 31.7 per cent; forearm, 30.7 per cent; leg, 22 per cent; thigh, 15.3 per cent. The missiles causing the fractures (195) have been proportioned as follows: bullet, 49.8 per cent; shell, 34.3 per cent; shrapnel, 9.7 per cent; grenade, 2 per cent; undetermined, 4.1 per cent.

FIG. 39.—OSGOOD-PENHALLOW HUMERUS SPLINT.

Note that length of humeral portion may be altered by releasing screw. Support for hand, holding wrist dorsiflexed and fingers extended—for musculo-spiral paralysis. For uncomplicated fracture of humerus splint would end at wrist, permitting of movement of wrist and hand. For forearm fractures, wrist would be about half dorisflexed upon a similar support. Support may be altered to suit the length of forearm.

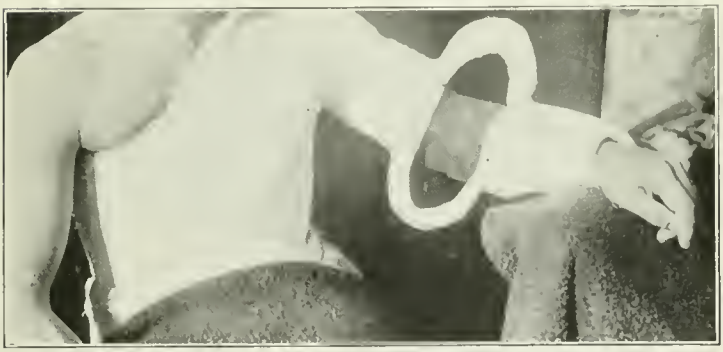

FIG. 40.—BRIGGED PLASTER FOR FRACTURE OF LOWER END OF HUMERUS.

In case of forearm involvement, plaster would be continued over hand to prevent wrist movements and rotation of forearm.

To face , age 67 !.

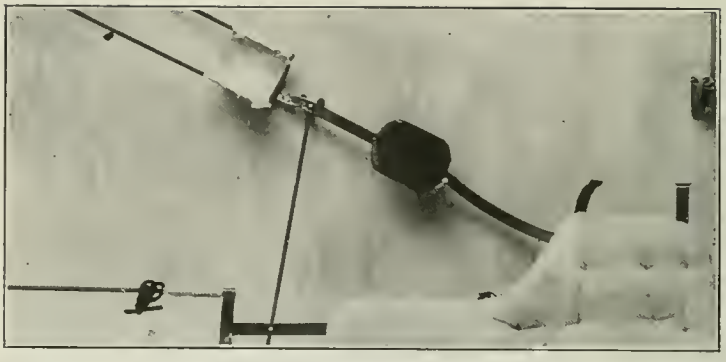

FIG. 41.—JONES' ABDUCTION FRAME FOR FRACTURED FEMUR (RIGHT).

Body fixed to padded portion by strap from the curved lateral steel rods across chest. Left thigh and leg bandaged to frame. Right knee rests upon oblong plate. Traction to right leg by means of screw. Counter-traction by a groin strap on left. Any degree of abduction attained by long transverse screw. Right thigh and buttock left free for dressings.

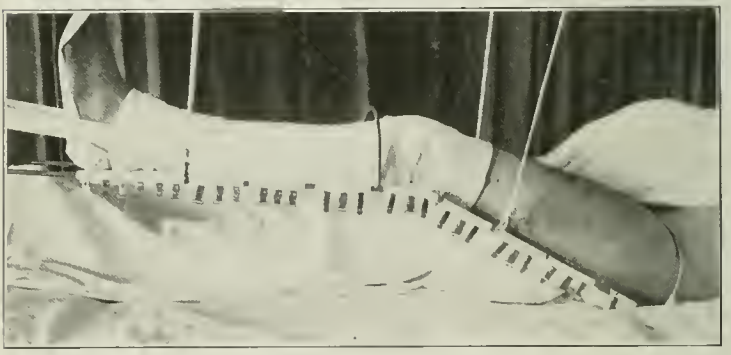

FIG. 42.—WIRE SUSPENSION SPLINT FOR FRACTURES OF THIGH OR LEG.

Suspended to a Balkan frame. Transverse supporting bands of elastic cotton, fastened by steel clips. Easily removed for dressing posterior wounds, without disturbing fracture. Toe-drop prevented by 2 pounds traction upon foot.

FIG. 43.—WIRE SUSPENSION SPLINT FOR FRACTURES OF ARM AND FOREARM.

Perforating wound with fracture of lower third of humerus. Dependent skin wound healed rapidly, making track water-tight. One tube carrying Dakin's solution to fracture focus. Transverse bands beneath wound are of rubber, for cleanliness. Four pounds traction from forearm. Suspended to Balkan frame.

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FIG. 45.—CABOT POSTERIOR WIRE SPLINTS, FIRMLY UNITED AND SUSPENDED TO BALKAN FRAME, FOR FRACTURES OF BOTH LEGS.

Posterior support of perforated zinc, with windows at site of posterior wounds.

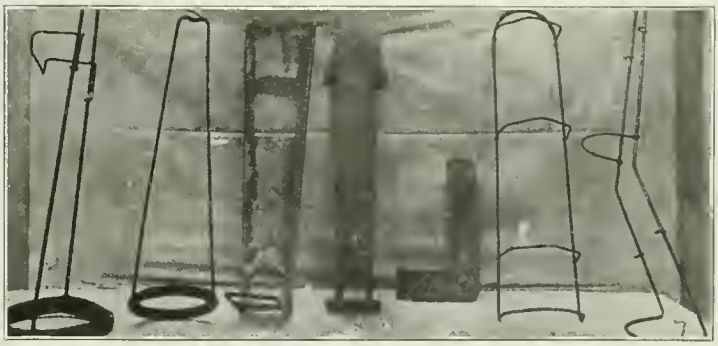

FIG. 46.—(1). Thomas leg splint, for transport extension treatment. (2). Arm splint for extension during transport. (3). Cabot posterior wire splint. Support made of perforated zinc. Windows may be cut as desired. (4). Wooden leg splint, for fixation during transport. (5). Angular wooden splint for fixation of arm and forearm during transport. (6). Frame of arm suspension splint shown in (Fig. 43). (7). Frame of leg suspension splint (Fig. 42).

Fig. 47.—Bridged Plaster of Leg. Three Bridges of Perforated Zinc Reinforced with Plaster.

Fig. 48.—Bridged Plaster in Case of Fracture of Lower End of Tibia, Involving Ankle Joint.

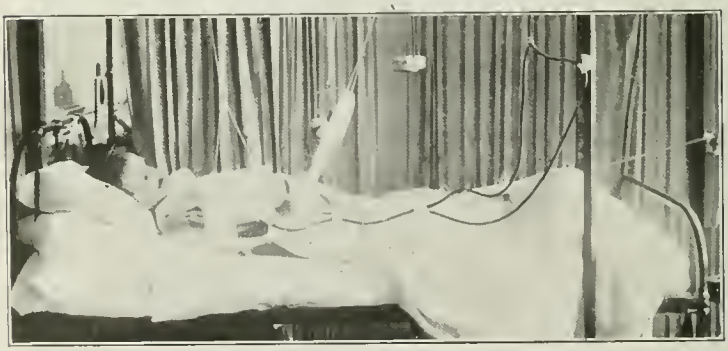

Fig. 49.—Fractured Humerus.

Suspension of arm by sling, of semi-flexed forearm by traction upward over a pulley. Four pounds traction from elbow in humeral axis. Shows sliding trolley of Balkan frame to which suspension cords are attached by pulleys, permitting of movement toward head or foot of bed.

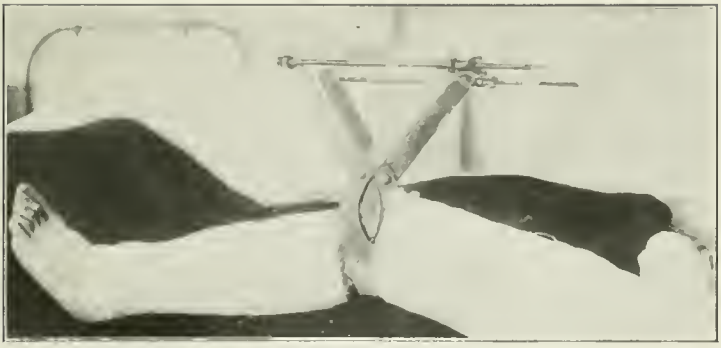

FIG. 50.—TURNER APPARATUS FOR CORRECTION OF CONTRACTURE AND STRETCHING OF ADHESIONS.

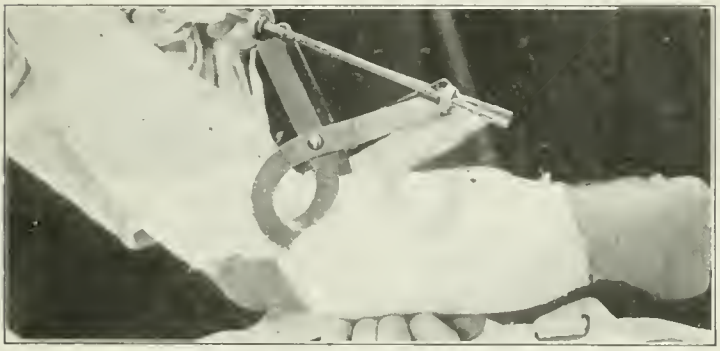

FIG. 51.—TURNER APPARATUS APPLIED TO ELBOW. THIS VARIES FROM THE KNEE APPARATUS, IN THAT FOREARM CAN BE FLEXED OR EXTENDED.

FIG. 52.—SPLINT FOR PREVENTION OF TOE-DROP.

Made of iron wire with coil at ankle. By decreasing the angle, increased tension is brought to bear on foot. Provides a springing support against which paralyzed muscles may exercise as they recover function. Does not hinder walking.

Flesh wounds have been of this order: perforating, 59.6 per cent; non-perforating, including gutter wounds, 40.3 per cent; of the perforating wounds, 14.2 per cent have had explosive exits. The majority of perforating and explosive wounds were caused by bullets; of non-perforating wounds, by shell fragments. The following table gives the percentage of the missiles causing the different wounds:

Wounds	Bullet	Shell	Shrapnel	Grenade
Perforating	68.7	18.7	12.5	0.0
Non-perforating	23.1	60.0	10.7	6.1
Explosive	60.9	34.8	4.3	0.0

Of 195 cases, 76.9 per cent have been infected; and 23.1 per cent non-infected. In the infected cases, bullet and shell have been in about equal proportion: bullet, 45.6 per cent; shell, 40.9 per cent; shrapnel, 10.2 per cent; grenade, 3.1 per cent. In the non-infected cases, the bullet has been the chief agent: bullet, 73.6 per cent; shell, 15.7 per cent; shrapnel, 10.6 per cent. Infected fractures have required both a longer time for union and a longer treatment. The average period required for union of infected fractures has been 70 days while of non-infected fractures it has been 50 days. Likewise, the average time of treatment at this hospital has been: infected, 137 days; non-infected, 74 days. This does not represent the total duration of treatment, for patients have not only been discharged from the service or sent back to duty, but they have been transferred to homes for further convalescence or to other hospitals for special treatment. It appears that infection has some influence in prolonging the healing of compound fractures; but just how much, it is not possible to estimate on account of the more severe flesh wounds and the greater comminution of the majority of infected fractures. As would be expected, infected fractures attain poorer ultimate function than the non-infected. Expressed in terms of disposal—that is, whether invalided out of the service, transferred to orthopedic hospitals for special treatment, to convalescent homes or to duty—the relative results are indicated as follows:

Fractures	Invalided	Orthopedic	Convalescent and duty
	Per cent	*Per cent*	*Per cent*
Infected	49.2	17.1	33.7
Non-infected	24.3	10.8	64.9

Complications have occurred as follows: non-union, 6.1 per cent; nerve injuries, 7.1 per cent; secondary hemorrhage, 0.5 per cent; ankylosis, 18.9 per cent; muscle and tendon adhesions, 3.0 per cent. This distribution is indicated in the following table:

	Non-union	Nerve injury	Secondary hemorrhage	Ankylosis	Tendon adhesions
Per cent of all fractures	6.1	7.1	.51	18.9	3.0
Arm	4	m. spir. 4 ulnar 1–5	0	shoulder 8 elbow 12–20	0 0
Forearm	5	radial 3 med. 1–4	0	elbow 4 wrist 0–4	6
Thigh	1	ext. pop. 3	0	hip 3 knee 4–7	0
Leg	2	ext. pop. 1 lg. saph. 1–2	1	knee 0 ankle 6–6	0

Of 195 fractures, about 5.6 per cent have required amputation. The majority of these had been amputated in France and about 55.5. per cent of them required re-amputation after admission. This is accounted for by the prevalence of flush amputations. It is uncommon to receive a healed stump here. One cannot but feel that the method has been too universally adopted. Undoubtedly it is often indicated by the poor condition of the patient, the virulence of infection, lack of time, or the need for the utmost economy of bone and soft parts. Yet there must be many instances in which a proper flap operation could be done. It would mean far less pain and exhaustion for the patient and a much shortened period of hospital treatment.

The fracture cases (195) have been disposed of as follows: invalided, 43.6 per cent; transferred to orthopedic hospitals, 15.7 per cent; to convalescent homes, 30.9 per cent; to duty, 9.6 per cent. The following table indicates the disposal of the different fractures:

	Invalid	Orthopedic	Convalescent and duty
	Per cent	*Per cent*	*Per cent*
Arm	38.4	25.0	36.6
Forearm	34.7	19.5	45.8
Femur	75.0	3.5	21.5
Leg	38.4	7.7	53.9

There has been only one death in 287 long bone fractures: in a case involving the head of the tibia and knee-joint, with resulting septicaemia.

A REPORT OF PHYSICAL EXAMINATION OF TWENTY THOUSAND VOLUNTEERS

By Major Clarence L. Cole, *Medical Corps*, U. S. Army; Captain E. W. Loomis, *Medical Reserve Corps*, U. S. Army, and First Lieut. Eugie A. Campbell, *Medical Reserve Corps*, U. S. Army.

THIS paper is prepared with a view of presenting the results of physical examination of about twenty thousand young men, volunteers, in the states of Arkansas and Texas during the spring and summer of 1917. The statistics herein presented will give an approximate idea of the enormous number of men in the United States of military age who are physically disqualified for military service.

While these statistics were compiled to show the number of physically defective men who may be made fit for military service by means of proper surgical, sanitary, or medical supervision, its ulterior motive is to direct the attention of the reader to the benefit that would come to our population in general through the added health and vigor which would follow universal application of corrective measures to the large numbers of its deformed and physically deficient male members.

The standard upon which these physical requirements are based is the one prescribed by the United States Army, though the application of this standard differed somewhat in the two states.

In Arkansas more than four thousand men were examined by Maj. C. L. Cole, Medical Corps, U. S. Army.[1] These examinations were conducted subsequent to the declaration of war with Germany.

By far the greater number of applicants for the first Officers' Training Camp came from the States of Arkansas, Oklahoma and Louisiana.

Arkansas Infantry.—The records of examination of the regiment for 1,281 men present show 318 men to have been rejected, or about 25 per cent. The chart entitled "Arkansas Table No. 1" presents the details of this examination. On referring to the chart, it will be seen that, of the 318 men rejected, 153, or 48 per cent, had correctable deformaties. The character of these defects is shown in Arkansas Table No. 2.

"Arkansas Table No. 3" presents the conditions found in 165 men of the regiment. These conditions primarily were the cause of

[1]State Medical Examiner for the militia of Arkansas and examiner of applicants for the first officers' training camp at Fort Logan H. Roots, Arkansas.

rejection and, from the nature of the disability found, or its presence in conjunction with other conditions, the men were not considered suitable for service, and the disability is reported not correctable.

Felony.—Five men in this regiment admitted having been convicted of crime and of serving sentences in penal institutions. This admission followed the reading of the 54th Article of War to the men prior to the examination and upon direct interrogation by the examining officer. This record disqualifies for service in the Regular Army.

Flat Feet.—Under this heading there were some men classified as "incorrectibly deformed." Proper exercise no doubt would restore a few of these to a serviceable condition. It is believed that men otherwise sound should not be rejected for flat feet until they are found unable to render military service after a period of observation.

Declined Operation.—There were a number of men who had correctible disabilities, and in each case the applicant was asked if he would consent to operation if accepted. Men who refused to consent to operations were rejected. In time of national need, rejection should not be dependent on such personal choice.

Upon completion of the examination of candidates for admission to the Officers' Training Camp at Little Rock, Ark., it was found that, out of this educated and selected class of men, 30 per cent had been rejected on account of physical disability.

It has not been possible to prepare tables and charts of these men, on account of service in compliance with official orders, although records were kept with great care. The examiner is convinced that the percentage of rejections for physical defects is more approximately representative of the class of men examined as a whole, rather than that of the Arkansas Militia.

In the work only with the student candidates, the examiner was fortified by the experience gained in examining the Arkansas Infantry, which suggested the development of a more thorough organization for the conduct of the work. Three additional medical officers of the Regular Army were then present, two of whom (with twenty years' military experience) acted as reviewing officers and reëxamined all rejected men. These officers were Colonels William F. Lewis and Jere B. Clayton, Medical Corps, U. S. Army. The published standards for physical requirements were more rigidly adhered to in this examination, on account of the responsible positions the men would be called upon to fill. Yet a number of these rigidly examined men were discharged from the camp before the expiration of the three-months period of training for causes such as tuberculosis;

syphilis, results of old injuries, and a number of other maladies of which the applicant had thought himself cured.

The hospital record for the two groups of men accepted for service and serving in the same military station for a period of three months indicates that elimination of defectives has been fairly thorough. The sick of this camp treated in the camp hospital was, normally, lower than 1 per cent. During the existence of the camp, surgical procedures for non-accidental conditions, disqualifying members from performance of duty, did not exceed twelve. Only two deaths occurred in accepted men for the entire period. One death was due to bronchopneumonia following measles; one death was due to drowning.

Upon being detailed to conduct the examination of the Texas Militia, the lessons learned in the previous assignments were applied in developing an organization, which could complete, with the greatest possible speed and accuracy, the physical examination of a large number of men belonging to small organizations widely separated from each other over the vast area of the state of Texas.

The officer detailed as state medical examiner of Texas, who directed examination of men reporting for the April muster, had been assigned to other duty prior to the August muster. An assistant state medical examiner performed the duties required, such as the reviewing of applications for discharge and all other matters relating to the militia of the state of Texas then in the federal service, in the interim between completion of the first examination and the detail of Major Cole on August 2, 1917. The assistant state medical examiner was relieved by Capt. E. W. Loomis, of the Medical Reserve Corps, who, in addition to the duties above defined, has, with the assistance of 1st Lieut. Eugie A. Campbell, Medical Reserve Corps, compiled the statistics presented.

Reproduction of such correspondence as was required to inaugurate the plan of examination is presented for such assistance as it may offer to others given a detail of similar character:

"August 4, 1917.

From: The State Medical Examiner, Texas Militia.
To: The Chief Mustering Officer, Southern Department (Through the State Mustering Officer of Texas).
Subject: Organization for Physical Examination of Militia at Initial Muster.

1. Request that the following named medical officers of the Texas Militia be ordered to San Antonio for duty, in instruction for and or-

ganization of examining parties, in conducting physical examination of the Texas Militia at the initial muster:

J. H. Gambrell, Major, Medical Corps, Texas National Guard. Homer T. Wilson, Major, Medical Corps, Texas National Guard, now in San Antonio. Everett E. Jones, Major, Medical Corps, Texas National Guard; home station, Wichita Falls, Texas. Robert A. Hasskarl, Major, Medical Corps, Texas National Guard; home station, Brenham, Texas. Charles S. Gates, Lieutenant, Medical Corps, Texas National Guard; home station, Giddings, Texas. Arthur S. Brown, 1st Lieutenant, Medical Corps, Texas National Guard; home station, Abilene, Texas. Jacob O. Carpenter, 1st Lieutenant, Medical Corps, Texas National Guard; home station, Clifton, Texas. Byron S. Bruce, 1st Lieutenant, Medical Corps, Texas National Guard. One Dental Surgeon, home station not known.

2. It is believed that the physical examination of the organizations of the Texas Militia can be expeditiously handled by pursuing the following plan: The examination to be started at San Antonio on Monday, August 6, or as soon thereafter as the above named medical officers can report.

3. The State Medical Examiner will personally supervise the examination of the organizations in San Antonio, and instruct the militia medical officers ordered to report at San Antonio, in the method of expeditiously performing their duty. As soon as these medical officers have been instructed, their names will be submitted for assignment to the following stations, where they will organize sub-parties, following the method pursued at San Antonio.

4. The stations are, in addition to San Antonio: Houston, Dallas, and Waco. From these sub-stations the parties of the necessary strength can be sent to adjoining towns to conduct examination of organizations consisting of 100 men, more or less. There will remain an area of wide extent in western Texas, for which provision will be recommended at a later date, when the efficiency of the medical officers above requested has been determined and their capacity for performance of the duty ascertained.

5. There has been requested assignment, through the Department Surgeon, Southern Department, of four medical officers of the Reserve Corps and six noncommissioned officers of the Regular Army. It is desired that these men be distributed as the Medical Examiner may consider necessary in conducting and recording the work of the office and assignment as assistants to the respective medical officers sent here for instruction.

C. L. Cole,
Major, Medical Corps, U. S. Army.

The officers were assigned as requested, and after a limited period of service at San Antonio, Tex., the following officers were assigned

as directors of examining parties at the cities named: Major J. H. Gambrell, Medical Corps, Texas National Guard, Dallas, Texas; Major Everett E. Jones, Medical Corps, Texas National Guard, Waco, Texas; Major Robert A. Hasskarl, Medical Corps, Texas National Guard, Houston, Texas; Major Homer T. Wilson, Medical Corps, Texas National Guard, San Antonio, Texas.

August 5, 1917.

From: State Medical Examiner, Texas National Guard.
To: Department Surgeon, Southern Department.
Subject: Equipment of Recruiting Parties, Texas National Guard.

1. The approved plan submitted by this office to the Chief Mustering Officer, Southern Department, for physical examination of Militia at initial muster is as follows: There will be four main parties conducting this work from San Antonio, Waco, Houston and Dallas. At these points the larger number of men are to be found.

2. It is desired that efficient Medical Officers, whose names have been submitted, be ordered to report at San Antonio as soon after August 5 as the travel can be performed. The State Medical Examiner will organize the work and instruct these Officers in their duties and subsequently recommend the assignment of suitable men to the stations above named. On completing the examination of the larger numbers of men at these stations, it will be necessary to subdivide the parties for examinations at the sub-stations. The San Antonio district will comprise the following sub-stations:

Kerrville	Brownsville	Victoria	Lockhart
Uvalde	Corpus Christi	Cuero	Bastrop
Laredo	Beeville	Gonzales	La Grange
Harlingen	Goliad	Seguin	San Marcos
San Benito	Floresville		

The Houston district will comprise:

El Campo	Galveston	Orange	Jasper
Bay City	Brenham	Huntsville	Graveton
Wharton	Beaumont	Kirbyville	Lufkin
Angleton	Port Arthur		

The Waco district will include:

Abilene	Gatesville	Corsicana	Grosbeck
Brownwood	Itasca	Hubbard	Crockett
Comanche	Hillsboro	Mexia	Nacogdoches

The Dallas district will include:

Cleburne	Sulphur Springs	Denton	Wichita Falls
Tyler	Greenville	Sherman	Vernon
Ferris	Paris	Gainesville	Quanah
Fort Worth	Bonham	Decatur	Crowell
Pittsburg			

Those remaining unprovided for in the extreme western part of the state and the Texas Panhandle are as follows:

El Paso	Lubbock	Amarillo	Presidio
Big Spring	Childress	Marfa	Terlingua
Sweetwater	Clarendon	Shafter	

Provision will be made for examination at these stations by subdivisions of the four main parties as the efficiency of these parties becomes apparent.

3. There is submitted herewith a requisition for the necessary equipment required for one main party, to be used at San Antonio. Three similar requisitions will be submitted about the eighth of August for the supply of the remaining main stations.

4. Expression of approval of this plan, or suggestion of such alterations as may seem expedient, is desired.

C. L. Cole,
Major, Medical Corps.

This plan was approved without alteration and made effectual.

From the roster of medical officers in the Texas National Guard, the names of the necessary number of officers were selected to organize complete examining parties as indicated above. Request was made for orders assigning the officers to the several parties.

An additional party was organized at El Paso, Tex., under the direction of 1st Lieut. Byron S. Bruce, Medical Corps, Texas National Guard. This party examined organizations in western Texas. An additional party was later organized, in emergency, to examine men in a group of towns in a locality in which typhoid fever was prevalent, in order to insure vaccination of the soldiers.

[*Emergency*] SPECIAL REQUISITION FOR SUPPLIES

STATION: Office of Examining Surgeon, N. G. Troops, Waco, Texas.
FROM August 7, 1917, TO December 31, 1917.
COMMAND: Officers and Enlisted Men, 5,000; Total 5,000.

Articles	Expended during year ended Dec. 31 last	On hand	Wanted	Remarks (The necessity for the articles required will be plainly and briefly set forth under this head)
Stationery				
Envelopes, official, large	0	0	200	For mailing reports.
Envelopes, official, letter	0	0	200	For mailing reports.
Erasers, rubber, pencils, pieces	0	0	2	
Paper, typewriter, cap 250 in pkg	0	0	1	For mailing reports.
Paper, manif. caps. 250 in pkg.	0	0	1	For preparing Numerical 1.
Paper, carbon, 100 sheets in box	0	0	½	For preparing Numerical 1.
Pencils, lead, No	0	0	12	For preparing Numerical 1.
Miscellaneous				
Alcohol, denatured, 5 gal. bot.	0	0	2	For use in alcohol stove.
Alcohol, 1 qt., tins	0	0	4	For sterilizing arms.
Applicators, for throat, wood, gross	0	0	1	For applying iodine.
Forceps, thumb, 6 inch	0	0	2	For sterilizing needles.
Pans, agate (Keystone gray, enamel dairy pans, Kress & Co.)	0	0	2	For sterilizing needles.
Recruiting outfit, emergency, Par. 952, M. M. D. 16, No.	0	0	2	For examining recruits.
Stoves, alcohol, No	0	0	2	For sterilizing needles.
Syringes, glass, Leur type, 2 cc.	0	0	4	For anti-typhoid serum.
Syringes, extra needles, doz	0	0	2	For anti-typhoid serum.
Tr. iodine ½ strength in 2 oz. bot., bots	0	0	6	For sterilizing arms.
Towels, hand, doz	0	0	1	For use in giving vaccines.

I CERTIFY that the supplies asked for are necessary for the public service for the reasons set forth under the head of "Remarks," and that no more of them are on hand than as stated.

.....

Date,....., 19.... .....

REQUIREMENTS, PERSONNEL AND EQUIPMENT OF EXAMINING PARTIES, INITIAL MUSTER TEXAS STATE TROOPS

The organization, personnel and equipment, for examination of the Texas State Troops to be instituted on August 6 throughout the various portions of the state until all troops are physically examined for muster, will be as follows:

There will be not less than six medical officers, one dental surgeon, the necessary number of enlisted men to provide each medical officer with one clerk; there also being required not less than six additional

enlisted men, three of whom should be capable of using the typewriter and preferably proficient in writing technical medical terms.

The examinations will be conducted as follows: On notification by the mustering officer of the hour of the appearance at the appointed place for examination, the company will report, and the company commander will turn over to the medical examiner a copy of Form 10 or Form 135-1, with all data completely prepared up to the blank space used by the medical examiner. Article 54, Manual of Court-Martial, With Explanation, will be read to each company by a designated officer, and the members of the organization will be informed that all answers to interrogatories propounded by the medical examiners will be freely given, in strict compliance with the provisions of this article of war.

The members of the company organization will be stripped, caused to remain silent, and at least one company officer, preferably the captain, will remain at Examining Station No. 2 while his organization is being examined, when the company officer will be examined, the last in his respective company.

The conduct of the examination will be as follows: The entire enlisted force of the company, having been stripped, will be formed in file, and each man, having been given his particular blank form (10 or 135-1, as the case may be) and a physical examination card, will in turn present them to the clerk at Station No. 1.

The clerk at Station No. 1, with typewriter if possible, otherwise a man who can write legibly in longhand, will put a serial number on the physical examination card and give the same number to the soldier's physical form, and, after having given the serial number, will write the soldier's name at the top of the paper in the following order: Surname, Christian name and middle initial. The soldier will then be given the physical examination card with the physical form, both of which he will carry with him to each subsequent examining station. When the examination has been completed, the physical form (10 or 135-1), with the physical examination card, will be surrendered by the soldier at the designated station. A noncommissioned officer who has had experience in the federal service will be in charge of that portion of the examination conducted at Station 1. This noncommissioned officer will exercise the men in groups of ten as prescribed in General Orders 66, War Department, 1910, noting on the physical examination card all deformities, stiff joints, short limbs, scars, etc., made evident by his observation of the performance of the physical test prescribed. This noncommissioned officer will announce to a clerk, or personally record, such deformities at the top of the soldier's physical examination card as he may find and initial the card. The soldier will then be given his physical form and physical examination card and will pass to Station No. 2.

Personnel and Equipment Required for Station No. 1.—Two soldiers (one experienced noncommissioned officer, Regular Army, and one clerk); adequate supply of blank physical examination cards; indelible pencils; one desk; one typewriter, if possible.

STATION NO. 2

The soldier will pass to Station No. 2 and will surrender his physical form and physical examination card at this station. A medical officer of experience in physical examination and with personal force and quick decision must be selected for this station. This medical officer will examine the applicant with as great rapidity as possible in the following manner, dictating to his clerk all departures from normal observed by him and indicating his action, with the term "accepted" or "rejected." The clerk will enter the medical officer's initial at the end of such remarks as have been made by the medical officer.

The medical officer will palpate the patient's skull, examining for depressions, old scars, etc. He will examine the conjunctivae, the nasal passages, the mouth, the ears and the membrana tympani, palpate for glands in the neck, etc. Palpate the elbows to determine presence of enlarged epitrochlear glands. Examine the heart and lungs with the stethescope. Examine the chest and general muscular development. Examine for herniae, varicocele, abnormalities, as undescended testicles and for evidences of venereal disease or deformities. Examine the anus for detection of hemorrhoids, fistulae, pilondail sinusus, etc. Examine the legs for varicose conditions and deformities. Examine the feet for detection of hammer toes, ingrown toe nails, flat feet, bunions, corns on toes and soles of feet, and other deformities.

While this examination is progressing, the medical officer endeavors to arrive at a conclusion without unnecessary delay. The remark "accepted," "rejected," which applies is not erased. The examiner's action is indicated by initial. In any case where immediate decision cannot be rendered, the man will be held for examination as directed by the chief medical officer of the party.

Personnel and Equipment.—One medical officer; one clerk with ability to write legibly and rapidly in longhand the dictation of the medical officer; one stethescope; one table for use of the clerk; indelible pencils.

STATION NO. 3

A dental surgeon and one clerk. The soldier, on arrival at Station No. 3, will surrender his physical form and physical examination card to the clerk at this station. The dental surgeon will examine and dictate to the clerk the result of the examination of the soldier, giving the number of missing teeth and number of unserviceable teeth, indicating their position, as right and left, upper, number and lower, number and also note bridge work present, as well as artificial restoration. The

dental surgeon will indicate his acceptance or rejection as the result of his examination on the physical examination card by initial. The minimum requirement in this case is an opposing upper and lower molar on both sides.

Personnel and Equipment.—One dental surgeon, one clerk, with one table, and indelible pencils.

STATION NO. 4

The soldier will promptly pass to Station No. 4, at which the height, weight and chest measurement will be taken and recorded on the physical examination card. The medical officer or noncommissioned officer performing the duty of Station No. 4 will keep before him the comparative minimum table of weight and height and chest measurement which follows:

Height inches	*Pounds*	*Expiration*	*Mob.*
64	120	30	2
65	122	30	2
66	124	30½	2
67	126	31	2
68	129	31¼	2¼
69	133	31½	2½
70	135	32	2½
71	142	32¼	2½
72	149	32¾	3
73	156	33¼	3

These minimum allowances only apply in case the applicant is "active, has firm muscles, and is evidently vigorous and healthy."

The normal weights for the respective heights of the men and the chest measurement may be determined by adding the following measurements to those above given:

Height, inches	*Chest at expiration, inches,*	*Weight, pounds*
61 and under 64	1	8
64 and under 68	2	10
68 and under 69	2	12
69 and under 70	2	15
70 and under 73	2	20
73 and upwards	2	24

He will indicate "accepted" or "rejected" by erasure of the word which does not apply when applicants vary from the allowance authorized, the minimum height being 61 inches and the minimum weight 110 pounds. The examiner will initial the report on the physical examination card.

Personnel and Equipment.—One medical officer or intelligent noncommissioned officer; one clerk, with one height scale, one set scales and weights, one tape measure, one desk and indelible pencils.

STATION NO. 5—EYE AND EAR EXAMINATION

The work of this station will be conducted in a suitable room in which the soldier may enter and after examination pass out at the opposite end of the room. The vision and hearing will be tested in this room, using the Snellen test card furnished by the Medical Department and recording the result of the examination in fractions. For normal vision, the soldier being 20 feet from the card and reading all letters correctly, the report will read 20/20. If he reads all but three letters, the result will be recorded 20/20—3. Should the soldier's vision be below the normal, that error will be recorded which the soldier shows himself to have, using the figure 20 for the numerator and 30, 40, 70 and 100, as the case may be, for the denominator. No soldier will be marked "accepted" with defective vision who has less than 20/40 right eye and 20/100 left eye, or one having organic ocular disease.

Hearing.—The hearing will be tested by the whispered and spoken voice, the medical officer being at a distance of 20 feet from the soldier and recording normal as 20/20; any departure from normal is recorded by using the number of feet from the soldier at which the whispered voice is heard; the same test is applied for the spoken voice. The medical officer will note acceptance or rejection on the physical examination card and initial after having completed the examination.

Personnel and Equipment.—One medical officer, two enlisted men, with one Snellen test card, indelible pencils, and one desk. In determining difficult cases, the examiner should seek to obtain the use of test lenses and instruments of a local oculist, if possible.

STATION NO. 6—VACCINATION STATION

A medical officer will superintend the administration of the typhoid and smallpox vaccine and his party will be organized as follows:

No. 1 Hospital Corps attendant applies iodine to the right arm at site of insertion of the deltoid muscle. He then washes a small area on left arm with 95 per cent alcohol over the deltoid muscle.

Nos. 2 and 3 Hospital Corps attendants attend to the sterilizer, typhoid prophylactic ampules and syringes, and administer the prophylactic subcutaneously at the site on the right arm to which iodine has been applied by the first attendant. At the same time, No. 4 attendant applies the smallpox vaccination to the left arm of the soldier. The record of inoculation is made on the physical examination card and initialed by the medical officer.

Personnel and Equipment.—One medical officer, four enlisted men of the Medical Department, with two tables, one alcohol stove, one sterilizer (agateware basin), two glass Luer syringes, one file, Tr.

iodine, 95 per cent alcohol, *grain*, denatured alcohol for stove, absorbent cotton, applicators.

STATION NO. 7

At Station No. 7 the finger-print records of the soldier will be taken.

Personnel and Equipment.—One noncommissioned officer, one private, with finger-print record blanks, inking pad, roller, cotton waste for wiping fingers, pen and ink for signature of the card by the soldier, and indellible pencils.

In order to expedite this work, other Hospital Corps men are instructed as rapidly as possible in the procedure, and strips of glass of appropriate size and shape are made use of for inking pads. These may be secured locally.

STATION NO. 8

One medical officer with the greatest experience of the party, in army physical examination blanks, and one clerk with typewriter, transcribe the notations made on the special physical examination card to the regulation blank physical examination Form 10 or 135-1. These remarks are dictated by a medical officer from the notes made by the examiners. This work will be conducted under the immediate direction of the senior officer of the party in order that he may decide the final action upon questionable cases as they arise during the progress of the examination, thus preventing confusion of records or unnecessary recalling of soldiers from organizations for repeated examination. The senior officer enters on the final space on the examination card any cause of disability and indicates his action.

The officer in charge of the party will have compiled and checked daily reports of the examination, giving name, rank and organization of the men examined. This report will show the names of men examined in four groups: (1) Those men examined and passed who conform to physical requirements. (2) Those men examined and rejected with recommendation of waiver naming the defects. (3) Those men examined and rejected for whom no waiver can be recommended. (4) The names of all absentees.

One copy of the above letter should be kept for record, one copy forwarded to the office of the state medical examiner, and two copies forwarded to the district mustering officer. In case the district mustering officer delegates the authority to take final action on all cases recommended for waiver to the district medical examiner, the final action may be indicated on the soldier's physical form. For this purpose, the use of a stamp as follows is authorized: "Defects Waived, Par. 16, S. R. No. 55, W. D., 1917."

All physical forms of soldiers which show any deviation from normal will bear the following stamp in the heading "remarks:" "Defects

Existed Prior to Date Soldier Reported at Company Rendezvous. Par. 16, S. R. No. 55, W. D., 1917."

Those men who are suffering from physical disability which prevents the soldier from performing the duties of a soldier will bear the following stamp: "Recommend Discharge on Certificate of Disability. Par. 19, S. R. No. 55, W. D., 1917."

Upon receipt of certificates of disability, properly filled out by the soldier's commanding officer, the district medical examiner will complete the certificate of disability and forward the same to the district mustering officer.

All district medical examiners will report daily, on completion of examinations for the day, by wire to the state medical examiner, the number of men examined, the number rejected; the designation of organizations examined, and the addresses of the examining parties under their control for the following day.

The district medical examiners will require, on Medical Department blank requisition form, through the Department Surgeon, Southern Department, for all supplies necessary in conducting their work. Each district medical examiner will submit to the Department Surgeon, Southern Department, the required number of copies of the requisition for necessary initial supplies for the party, and subsequent requirements shall be requested by requisition as needed.

Official blanks for telegraphic reports will be secured from the district mustering officer as needed. Physical examination cards, stamps and stamp pads will be supplied, upon request, by the state medical examiner.

Upon completing the transfer of data from physical examination cards, the senior medical officer of the party will note on the last space on the card all disqualifying defects found and initial all cards. Each card showing disqualifying defects will bear the appropriate stamp showing the action taken by this officer as stamped upon Form 10 or 135-1 for the individual in question.

The completed physical examination cards, after they have fulfilled their purpose for reference at the station of examination, will be promptly mailed direct to the state medical examiner for permanent file. All correspondence relative to purely medical matters will be forwarded direct to the state medical examiner. All correspondence relative to military matters will be forwarded to the Chief Mustering Officer, Southern Department, through the district mustering officer.

C. L. Cole,
Major, Medical Corps, U. S. Army,
State Medical Examiner.

(*To be continued*)

EDITORIAL

SHALL THE FITTEST SURVIVE?

Students of the history of sanitation could not fail to be convinced that "survival of the fittest" is indeed an inexorable law of nature, for notwithstanding that time and again, often through the most trying experiences, sanitarians have practically demonstrated the right way to make all fit, they find the people falling back into the same old rut, so that nature might the quicker dispose of them. True there seems to be a determined effort on the part of some to preserve the unfit, as such, thus handicapping the fit to their un doing, but the larger, unconscious effort is to observe the rule, playing no favorites, and letting each individual survive or perish as nature shall determine.

Regarding military sanitation, however, there is a difference, the history of which would indicate that notwithstanding the rule, in war the people, with the best intentions, appear to be ignorantly determined to promote the destruction of their fittest friends, thus helping the enemy, and leaving the more or less unfit to survive. All of which is evidenced, particularly with us, by failure to provide a proper sanitary organization to prevent the unnecessary destruction of the fittest. Even now, in the second decade of the twentieth century and the second year of the war, we are face to face with a repetition of the same old ghastly errors.

Need we ask what happened in our Revolutionary War, in 1812, the Mexican War, the War of Secession, the Spanish War? All is a matter of record to be consulted by those who wish to avoid, any such there be, the pitfalls that confront our Army in this the greatest of wars.

The most glaring fault in each of these wars was the utter failure to appreciate the stupendous responsibilities that would of necessity be thrust upon the Medical Department, and to organize and equip this department to meet these responsibilities. This same failure threatens us at this moment.

Certain distinct advantages we have that we never before had. We know the proportion of officers and men we need to meet our responsibilities and these have been authorized by law, thank God! We have our formations, equipment and regulations as never before, and we have a larger number of officers trained in their use. A wonderful advance, but we have no adequate military administration to coördinate these elements.

Boards there are galore, all professional, each working out its own problems, oblivious that scores of other boards are working out theirs and that the end results of all must be a compromise between the best and the possible. These efforts, which might be most valuable to the country, must be coördinated if the best results are to be obtained, and this coördination can come only through proper organization.

The important question is, do the Medical Department and the medical profession possess the ability and experience to organize this great special medico-military machine, or must we look to others to make and direct our organization? And if to others, what others have knowledge and experience of the special functions and mangement of our department greater than we ourselves?

In the military profession, reversing the rule in other professions, all officers begin as specialists and a few end as generalists. We have infantrymen, cavalrymen, artillerymen, engineers, ordnance men, signal men, intendance men, not to mention sanitary men, each of whom claims the secrets of his own specialty as his own and resents intrusion into them by his fellows. A cavalryman regards the infantryman from the altitude of his horse's back, while both consider the gunner as a thing apart and all three regard the staff, so-called, as something to be condemned in public and envied in private, but each is necessarily without deep knowledge of the other's specialties.

In one thing, however, all these specialists are in accord—the conviction that each and all of them know more about the organization, function and management of the sanitary department than any medical officer could possibly know, no matter his experience and accomplishment.

From among these specialists there develop a few generalists, who, through superior ability, study and experience have gained a knowledge of all the specialties; these are known as general officers and, as a rule, are very able men. There is one specialty, however, in which but few of them can have personal experience, and that is the Medical Department. They may observe it as the medical officer observes the other military specialties, through more or less intimate contact, but they have not its point of view.

Answering our question, then, we believe that the officers of the Medical Department of the Army do possess the ability and experience to organize and run their special military machine, the sanitary service, the efficiency of which they will be held responsible for no

matter who may organize it, and it is the clear duty of the medical profession and the people to see that they shall be permitted to do it.

It is not presumed for a moment that this military specialty is to be exercised apart from the other specialties, nor independent of the superior military authorities, such would be wholly incompatible with efficient service. All of these specialties must work together with a single object, to win the war with the least cost, in men and money, compatible with efficiency. To this end they must be coördinated, supplementing each other, and oblivious of everything but the sole reason for which they exist. But to get this result in the best way, each specialty must feel that it is given proportionate weight, consideration and reward with others in the organization.

The Medical Department asks for a personnel, for the management and control of the army of invalids for which it is held responsible, proportionate in numbers and grade to that of the other specialties of the Army, and an organization which will permit it to do the work the people require of it in the most efficient and economical way. It has not these now and, therefore, has not the organization which will permit it to do its work efficiently and avoid the criticisms which, for the same reason, have unjustly fallen upon it in all other wars. If it is not permitted to have such an organization, to be determined by experience and consensus of best medico-military opinion, by so much, the fittest will not survive.

SERVICE WITH THE BRITISH

A large number of our young Medical Reserve Corps officers are now under British control and not a few are chafing under the unfamiliar conditions, forgetting that they are here to help, not to oppose. The best test of an all-round man is that he quickly and cheerfully adapts himself to his surroundings and "when in Rome do as Romans do." We cannot fight side by side with our allies unless we adopt the methods which they have proved to be the best after over three years of bitter experience. Any disposition on the part of our medical officers to change, or even to modify those, at the front, will mean confusion and disaster. Absolute discipline on their part is quite as essential as restraint on the part of the line officer, as he advances behind the barrage restraining the impetuosity of the attack by his own coolness in conformity to the general plan of attack.

Much of the duty now assigned to young physicians in English camps and hospitals seems irksome and elementary, but it is necessary to fit him for the stern work "over there." He may think that many of the

British ways are slow and ultra-conservative; he may, through his own lack of tact, fail to penetrate the veil of reserve behind which our English brothers hide their warm and gallant hearts. They are ever ready to give a soldier's welcome to the real soldier, nor can we blame them even should they feel a certain superiority to us who have yet our spurs to win—they who have been through the fires of hell and yet fight on with no thought of yielding ground.

We must put ourselves in their place and be content to win their confidence and respect, slowly but surely. There is no place for our American brag and superior wisdom in this war. We cannot afford it. This war is a real *business*, and we must learn it. We must not forget that it has borne heavily upon them, that medical supplies and equipment are limited, that they are fighting for *all* the nations among the Allies, to whom they are a strong tower of defense. They need our help, they welcome it, and it is up to us to give it cheerfully, ungrudgingly, tactfully, without hurting their sturdy pride. One who has lived with the brave men who have given all for their country's honor, and regard every sacrifice as "all in the day's work," can only feel respect and admiration for them and become obsessed with the thought that we must not disappoint them, who expect so much of us.

Probably nearly two thousand members of the Medical Reserve Corps are now abroad, the majority being first lieutenants. Aside from those attached to base hospitals, these young men are scattered throughout hospitals in England and France, and many are in action on the British front. Some of the latter have been wounded and some have made the supreme sacrifice. Reports from British commanding officers in the trenches refer in terms of the highest commendation to the devotion of the American doctors, who have made good under fire. Fresh from civil life, they have shown that they are good soldiers and are upholding the high traditions of the Medical Corps.

The honor roll of the R. A. M. C. is long and shining with gallant deeds. We are replacing those who have made the supreme sacrifice for humanity, prepared to do the same deeds that they have done, to adopt the watchword that has made England great—duty.

H. C. Coe.

THE STANDARD FOR "DUTY"

Within certain limitations the size of the sick report is determined by the equation of the attending surgeon, and it requires not a little experience and strength of character properly to determine

who should be excused from duty, and for how long, on account of sickness. Particularly is this question difficult for our recently appointed medical officers, who have to reverse completely their attitude towards their patients, in this respect.

Usually in civil practice there is no question in the mind of the physician that the individual who seeks his services is really in need of them. Such is not inevitably the case in military practice; indeed the malingerer crop grows with ease of propagation, and we do not hesitate to state our conviction that a thoroughly efficient and sustained medical department, as against an inefficient and ill-sustained one, would make a difference of an army corps to the fighting line in an army of a million strength. It is quite too easy to think that the government is paying for it, and a few days, more or less, on sick report would make no difference. It might make a great difference in the aggregate.

The result obtainable by such a department is not so difficult to substantiate even from our own recent experience. The constantly non-effective in our Army in 1906 was 47.86 per thousand, in 1915 that rate was 25.22; the conditions were practically identical. We need not go into an explanation of the administrative details which led to this remarkable result, coördination between the chief surgeons and the adjutants general of the departments, reaching to the post commanders and the post surgeons, then on the invalids, every individual of whom was closely observed as to length of time "sick," suffice it to say the result was obtained, and 22.64 men per thousand were with the effective every day in 1915 who would have been on sick report in 1906. What this means to an army of a million is simply a matter of multiplication, but 22,000 additional men on the fighting line might mean the difference between victory and defeat. Unnecessary absenteeism on account of "sickness" was one of the grave faults charged to the medical department in the Civil war, indeed is the strongest argument now urged against its autonomy; though, as a matter of fact, it is the best reason in favor of an adequate medico-military organization. Our ultimate man will determine the result of the war, and it is the duty of the medical department to see that he is fit and fighting.

ASSOCIATION NOTES

A meeting of the Executive Council of The Association was held in Washington, April 29, for the transaction of ordinary business.

The Council authorized the investment of $15,000 of its reserve funds in the Third Liberty Loan and the transfer of the bonds to the custody of the Savings Committee.

The following named 624 officers, having met the requirements of admission, were duly elected members of The Association of Military Surgeons of the United States:

Medical Corps National Guard, U. S.

Majors

Francis J. Clemenger
John J. Moore
Hodge A. Newell

Captain

Charles G. Steinmetz

First Lieutenants

Frank O. Blossom
Eugene R. Cocks
Herbert A. Codington
Dorsey M. Hines
Charles N. Kavanangh
Howard L. Reed
Edgar W. Roberts

Medical Corps, United States Army

First Lieutenants

Edgar Erskine Hume
Newton S. Stern

Medical Corps, U. S. Navy

P. A. Surgeon

Montgomery E. Higgins

Assistant Surgeons

John C. Adams
Allen T. Agnew
Benjamin S. Davis
Isaac Dellar
Spencer A. Folsom
David R. Higbee
Daniel B. Kirby

Medical Corps, U. S. N. R. F.

Surgeons

L. R. G. Crandon
Charles W. Moots

P. A. Surgeons

F. Brush
John S. Plumer
Fleete S. Steele

Assistant Surgeons

Alfred L. Arnold, Jr.
Leon Barrach
Richard P. Bell
Frank M. Cleveland
Fletcher A. Dunford
Dove W. Green
Charles M. Hatcher
Otto V. Huffman
Carl C. Hugger
Ernest A. Knorr
K. A. Menninger
David G. Metheny
Henry B. B. Montgomery
Walter L. Rathbun
Ronald B. Rogers
Fred C. Smith
Edwin C. Thomas
Walter A. Yeakle

Medical Reserve Corps, U. S. Army

Majors

Irvin Abell
Franklin G. Balch
Walter V. Brem

Majors—Contd.

William A. Chapman
Charles A. E. Codman
Alfred E. Cohn
George A. Cralgin
Henry B. Delatour
William T. Dodge
Kendall Emerson
A. M. Farrell
Stanton A. Friedberg
Harry W. Goodall
Arthur R. Grant
George H. Gray
John A. Hartwell
William F. Hanan
Lucius W. Hotchkiss
Ralph Kaysen
William N. Kenzie
Ellis K. Kerr
Walter B. Lancaster
John W. Lane
Harry M. Lee
John R. McDowell
Alexander C. Magruder
William F. Marting
W. P. Morril
James E. Paullin
Simon W. Reichards
Stanley M. Rinehart
Wilbur A. Sawyer
Henry L. Stickney
T. Casey Witherspoon
Wiley E. Woodbury

Captains

Bartholomew M. Allen
Ellis S. Allen

Captains

Frederick E. Allen
George S. Allen
Lemuel A. Anthony
James H. Arnett
Joseph Aspray
Victor B. Ayers
Edgar G. Ballenger
John A. Balsley
William A. Beckemeyer
Victor Biddle
Edward S. Blaine
Rudolph Bloom
Fred H. Bloomhardt
James M. Bonham
Charles Brewer
Harry L. Brush
Thomas L. Butler
John W. Carroll
Francis F. Carter
W. F. Carver
Lee E. Casey
Ernest W. Cleary
Hony X. Cline
David Cohen
Young E. Colville
Gregory Costigan
James E. Cramond
Ernest N. Crockett
Charles C. Crosby
George L. A. Dale
George A. Darmer
William C. Deming
Joseph C. DeVries
Clarence H. Dobson
Bernard C. Dorset
Theo. Dorsett
Clarence E. Dunbar
William P. Dysart
John W. Earel
Joseph T. Edward
Harvey L. Eldridge
George E. Egloff
Leo E. Evans
Daniel B. Faust
Charles S. Ferguson
Silas L. Filkins
Claude R. G. Forrester
Sidney J. Francis

Captains—Continued

Germanus E. Gardner
Edwin A. Gerhart
W. A. Gerrish
R. D. Gist
Andrew Godfrey
Andrew J. Goodwin
Clinton E. Goodwin
Ernest C. Grosskopf
Malcolm Gunn
James McE. Guthrie
Ralph Hagan
Jacob H. Halderman
Gordon B. Hamilton
William J. Hammond
Herman Hendrickson
David M. Hemming
John R. Herrick
Lawrence R. Hill
Fred G. Hodgson
Erasmus G. Hoppins
Spencer S. Howe
Luther P. Howell
Andrew Hunter
Clarence B. Ingraham
Eugene K. Jandor
James G. Janney
Czar C. Johnson
Elliott P. Joslin
Robert C. Kirkwood
Henry W. Lang
W. M. Lacey
Albert Lessing
Hiram J. Lloyd
John A. McCofferty
Joseph L. McCool
Thomas H. McCrudden
Charles F. McCusker
Duncan B. McEachern
Andrew J. McGraw
Douglas McIntyre
Isaac W. McLean
William W. MacMillan
Gordon MacCracken
John S. Macnie
Edgar M. Marbourg
Irwin B. March
Nathaniel R. Mason
Roland O. Meisenbach

Captains—Continued

Edward M. Mikkelsen
Ambrose H. Mouser
Frank C. Murrah
Alfred J. Norman
William T. Owens
John R. Patton
R. P. Pearsall
John H. Peck
D. H. Pelletier
Charles F. Perry
Darwin B. Pond
Mardelle Y. Pope
Palmer A. Potter
Winfred B. Post
John B. Potts
Langus W. Prichard
Louis J. Pritzker
Clarence G. Rea
Phillip Y. Reedy
Edwin B. Rhea
Emil P. W. Richter
Martin P. Rindlaub, Jr.
Charles A. Robbins
Nicholas J. Shields
Alexander S. Sim
Lucian C. Smith
Leonard S. Steadman
David C. Straus
Hubert S. Steenberg
William M. Stockwell
Thomas A. Stoddard
John M. Sutton
Charles B. Taylor
James R. Torbert
Lewis N. Tupper
Herbert L. Underwood
James L. Walker
Mark H. Ward
Mortimer Warren
William H. Warren
Roy S. Watson
Charles A. Wayland
Harry C. Westervelt
Leroy M. White
Fred DeG. Wilson
Hugh S. Willson
Raymond A. Wolff
Jesse L. Wornack

Captains—Contd.
Eugene P. Wright
Antonio DeB. Young
G. A. Young

First Lieutenants

Theo. C. H. Abelmann
William L. Adams
William W. D. Akers
E. M. Atkins
Fred C. Albright
Edward B. Allen
E. D. Allen
Ewald H. Angermann
Harry C. Antle
Ray C. Ash
William L. Atkins
Richard B. Austin
Luther Bach
B. A. Baird
Joseph C. Baird
Justin G. Ballon
Percival A. Barker
Everett P. Barr
Hollis G. Batchelder
Howard M. Batson
Theo. T. Batson
W. E. Beach
R. J. Beeby
Raymond G. Bell
Paul B. Bender
Archibald K. Benedict
Maynard G. Bensley
Geo. W. B. Beverley
B. J. Bolka
Fred N. Bond
Sterling Price Bond
Baldwin Borreson
W. G. Bouse
J. Craig Bowman
Harry Boyd-Snee
J. D. Boylan
S. Biezis
James D. Biggs
Allen C. Biller
Benjamin T. Bitting
John C. Black
J. Bennett Blair
Cornelius B. Boyle
Charles R. Brenner

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Francis J. Broghammer
C. B. Bromberg
Lawrence J. Brookman
A. L. Brown
Frederick H. Brown
Robert B. Brown
Thomas H. Brown
William J. Browning
Henry Brunig
James H. Bryant
Hubbard T. Buckner
Ernest S. Bullock
Alexander Wm. Burke
Charles W. Buvinger
Ernesto Casini
A. S. Cerchini
Thomas Lee Chambliss
Francis T. Chase
O. E. Chenoweth
Albert B. Clark
Emor L. Cartwright
Millard C. Clark
Eido H. Clauser
Oscar Cleff
Harry R. Cogburn
Bernis D. Colby
Thomas A. Coleman
Charles D. Collins
Earnest S. Colvin
Walter L. Coolidge
C. A. Cooper
George H. Cooper
Thomas Cox
Leo P. Crimmin
George H. Crofton
Lloyd B. Crow
George L. Curran
J. E. Damron
Charles Dane
W. E. Dapp
R. E. Davis
Carl Henry Davis
Drexel L. Dawson
Joseph W. Dean
Philip Wm. De Garmo
Clarence S. DeLong
Ralph Deming
Clarence DeWeese
Julius E. Dewey

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Michael G. Dewey
John McC. Dickson
Edward H. Diehl
James F. Dobson
Nathan F. Doleman
James L. Downing
Ralph E. Duncan
W. G. Dye
Nelson C. Dysart
Leslie G. Eastman
Ambrose E. Edgerton
Charles D. Eldred
F. J. Elias
Calvin R. Elwood
C. F. Engels
Frederick A. Engstrom
Paul S. Epperson
Matthew S. Ersner
R. Etter
William H. Evans
Emanuel M. Fainer
Frank C. Farmer
Harold E. Farnsworth
James W. Farrior
A. O. Fasser
Allen G. Fechtig
Earl W. Fetter
George J. Field
Harry E. Flansburg
A. G. Fleischman
Ralph Falk
William O. Finney
Hugh M. Fogo
Juan H. Font
J. H. Fowler
William L. Fox
George C. Franklin
George Freiman
Arthur F. Fritchen
C. S. Fry
L. R. Gale
H. H. Gallatin
David M. Gardner
Bartholomew Gattuccio
Neil C. Geis
Albert C. Germann
Andrew J. Gettinger
George W. Getze
John T. Gibbons

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E. W. Goldman
Jesse A. Goode
Eugene H. Goodfellow
Albert S. Gough
William Gramley
Brooks C. Grant
John D. Grant
Leon J. Grant
George M. Gray
Horace Gray
Lewis Greenberg
J. C. Graffin
Wilho A. Groenlund
Abraham B. Gross
Harold Gross
Abraham B. Grossman
Charles S. Hamilton
James F. Hanna
John W. Hansen
Charles W. W. Harms
Martin E. Harrell
Joe A. Hartsell
A. W. Harrison
Karl L. Hayes
William A. Heap
Julius Heilbrunn
Russell R. Helm
G. E. Henschern
William F. Herbst
H. G. Hirsckle
B. W. Hoagland
Frank N. Hoffmeier
William George Hogan
Alwin Holden
John J. Holst, Jr.
James A. Honeij
Arthur Hooks
Arthur B. Howard
William A. Howard
Sherman R. Hurlbut
R. R. Huston
John C. Irwin
Charles R. Irving
Andrew J. Jackson
William J. Jackson
Foster Jarrell
Paul B. Johnson
Roy W. Johnson

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Robert G. Johnston
Angust F. Jonas
Edgar A. Jones
William C. Judd
Zeno Kaminski
Osee F. Keen
Walter E. Kelly
Garnet A. Kilpatrick
Archie P. Kimball
G. W. Kimball
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Albert L. Knisely
W. E. Koppenbrink
George Kornfeld
Otto Kothe
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Frank Lackner
John E. Lattimon
Thomas F. Laughlin
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Robert E. Lee
Morris B. Levin
Joseph M. Linett
D. E. Little
William T. Little
H. V. Logan
Salvator C. Lojacono
William E. Low, Jr.
L. Lugar
Ralph F. Luse
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Barnie L. McDonald
Wilbur F. MacDonald
William H. McCallion
Ralph R. McCarthy
Merle D. McCutcheon
Howard D. MacFarland
Burris B. McGee
Thomas A. McGrath
Sherman McKenney
H. E. McKibben
James E. McMeel
Edwin H. McMillan
Alex. G. Macpherson
Robert S. MacTaggart
Port McWhorter
Alva F. Maine
H. B. Markham
Dawson T. Martin

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William E. Masters
Earl E. Meister
Albert A. Mendez
Joseph F. Mieczynski
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James M. Moore
Merwin B. Moore
Paul Morrison
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Clive A. Moss
Ellis V. Moulton
Harold K. Monser
R. H. Monser
William D. Mueller
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James H. Nicholson
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Harry S. Norton
J. F. Oates
Benit Odegaard
Pope Webb Oden
Arthur W. Ogden
C. J. Ouellette
Lyman Onershiner
E. Y. Pare
Paschal J. Park
H. F. Parker
Vincenzo Pascale
Albert A. Pastene
Charles W. Peabody
Alonzo B. Persley
Charles E. Peters
Chester M. Peters
W. J. Pickett
Thaddeus S. Pierzynski
Joseph A. Pinckard
Charles E. Pitte
William H. Pollard
Ezekiel Pratt
L. W. Prescott
L. C. Presson
Robert W. Preston
Jesse R. Prichard
John R. Pryor
William K. Pudney
James J. Putnam

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John W. Ragsdale
Benjamin Rappaport
Wesley C. Redd
William C. Reese
H. B. Reuss
Robert L. Reynolds
Homer E. Rich
Alfred A. Richmon
C. D. Richmond
Frank P. Riggle
Howard M. Ripley
Paul D. Robason
Edward T. Robinson
Lewis B. Robinson
Leonard F. Roblee
George F. Roeling
Herbert W. Rogers
John C. Rogers
P. A. Rohrer
Fred B. Roy
R. H. Sanders
A. F. Sarver
Charles D. Saul
Joseph G. Savannah
Emil A. Schlageter
O. E. Schoenfeld
Louis W. Schreiber
Sylvio A. Sciarretta
Edward R. Schunk
Thomas B. Scott
Harry D. Sewell
Melvin A. Shade
Clyde E. Shedd
Wm. G. Shimeley, Jr.
Cyril E. Sheppard
Roy D. Short
Alonzo C. Smith
R. Earle Smith

First Lieutenants—Contd.
Harry F. Smith
Jacob S. Smith
Leney H. Smith
Samuel C. Smith
Ferdinand F. Siegel
John S. Simms
Bryant R. Simpson
K. S. Simpson
James R. Snyder
A. S. Solomon
Oliver K. Speer
Sidney L. Spiegelberg
William F. Spiller
Henry A. Spinger
Edwin S. Stenberg
John Sterns
Clarence G. Stigall
Walter F. Stilliger
Charles E. Stolz
Joseph Stomel
H. M. Strachan
Frederick E. Strozzi
Charles K. Stulik
Orril LeG. Suggett
William A. Swim
Norman H. Taylor
Roland E. S. Taylor
Richard E. Thacker
Robert E. L. Thacker
Harold B. Thompson
Adolph N. Thoms
J. E. M. Thomson
J. W. Thomson
Morris H. Twidall
R. R. Tomlin
James D. Trask, Jr.
Lester E. Tretheway
Arthur M. Tweedie

First Lieutenants—Contd.
Everett A. Tyler
Jacques S. Uhr
George M. Underwood
Joseph C. Vaughan
Arthur B. Walker
Joseph A. Wall
Aurelius McG. Wallace
Roscoe C. Ward
George Watt
R. A. Webb
Walter J. Weiser
Lewis J. Weishew
William Westrate
Clark A. Wilcox
William O. Whitaker
Albert E. Williams
R. H. Williams
Theo. R. Willis
Hal D. Wilmeth
Frank A. Wilmot
Donald R. Wilson
Harry H. Wilson
Irving G. Wiltrout
William R. Winne
Geyer C. Wood
James B. Woodman
Charles J. Woods
Lester E. Woomer
Hiram S. Yellen

Associate Member

Former Asst. Surgeon U. S. P. H. S.
Nelson DuVal Brecht

First Lieutenant
Herman P. Hodsen, S. C. N. A.

COMMENT AND CRITICISM

ADVANTAGES OF MEMBERSHIP IN THE PERMANENT MEDICAL CORPS OF THE ARMY

A bright young medical man about to offer his services to the Government would do well to consider the very great advantage it might be to him to at once enter the permanent Medical Corps of the Army, in which there are now a large number of vacancies, and in which his captaincy is assured after one year's service, with possibilities of even higher rank in the National Army.

At the close of hostilities he would have the situation wholly in hand; he could remain if he chose, with the advantage of promotion that had come to him during his service, or he could resign and go into private practice, equally with the temporary officers who will be mustered out and who, should they wish to remain permanently, could do so only after long delay, a searching examination and loss of rank. The following is the official notice.—EDITOR.

Preliminary examinations for appointment as first lieutenant in the Medical Corps, U. S. Army, are being held at numerous points throughout of the United States, on the first Monday of each month. Chemistry and physics have been eliminated as subjects of the examination, full information concerning which may be procured upon application to the "Surgeon General, U. S. Army, Washington, D. C."

To secure an invitation to report for examination, the applicant must be a citizen of the United States, between 22 and 32 years of age; a graduate of a medical school legally authorized to confer the degree of doctor of medicine; of good moral character and habits; and have had at least one year's post-graduate hospital interneship.

The Government cannot pay applicants any part of their expenses incurred in connection with the examinations, but due consideration will be given to localities from which applications are received, in order to lessen such expenses as much as possible.

Those who successfully pass the examination are commissioned first lieutenants in the Medical Reserve Corps, and sent to the Army Medical School in Washington, or a training camp, for a course of instruction covering a period of approximately three months, during which time they draw the pay and allowances of their grade. If, at the close of their instruction, they pass the final examination and are favorably recommended, they are commissioned first lieutenants in the Medical Corps of the Regular Army.

The Medical Corps consists of commissioned officers in number approximately equal to seven for every one thousand of the total enlisted strength of the Regular Army, authorized from time to time by law;

distributed among the grades, in ratios as follows: Colonels, 3.16 per cent; lieutenant colonels, 5.42 per cent; majors, 23.7 per cent; captains and first lieutenants, 67.72 per cent.

Promotion to the grades of major, lieutenant colonel, and colonel is by seniority, subject to examination.

The Surgeon General, under the permanent law, has the rank of brigadier general and is the chief of the Medical Department; he is selected from among the officers of the Medical Corps not below the grade of lieutenant colonel.

Pay and Emoluments.—To each grade is attached a fixed annual salary, paid in monthly installments, which is increased 10 per cent for each period of five years' service until a maximum of 40 per cent is reached. A first lieutenant receives $2,000 per annum, $166.66 monthly. At the end of five years (*during the period of the war, at the end of one year*) he is, after examination, promoted to captain and receives $2,400 a year, increased after five years' service to $2,640, $220 per month, and after ten years to $2,880 annually, $240 per month. The pay of a major is $3,000 a year, which, with 10 per cent added for each five years' service, becomes $3,600 after ten years, $3,900 after fifteen years, and $4,000 after twenty years, this being the maximum for this grade. The maximum monthly pay of lieutenant colonel, colonel, and brigadier general is $375, $416.66, and $500, respectively. In addition to their pay proper, officers are furnished with allowance of quarters according to rank, either in kind or, where no suitable government building is available, by cash commutation; fuel, light and forage for horses are also provided. When traveling on duty an officer receives mileage for the distance traveled, including the travel performed in joining first station after appointment. On change of station he is also entitled to transportation for professional books and papers and a reasonable amount of baggage at government expense. Groceries and other articles may be purchased from the commissary at about wholesale cost price. Instruments and appliances are furnished for the use of medical officers in the performance of their duties. Well-selected professional libraries are supplied to each hospital and standard modern publications on medical and surgical subjects, including medical journals, are added from time to time. At each military post there is also a laboratory and medical officers are encouraged to carry on any special line of professional study which appeals to them and fits them for their duties.

Officers of the Medical Corps are entitled to retire after forty years' service, or at any time for disability incurred in the line of duty. On attaining the age of sixty-four, they are placed on the retired list by operation of law. Retired officers receive three-fourths of their pay (salary and increase) at the date of retirement.

At the present time there are approximately seven hundred vacancies in the Medical Corps.

THE HISTORY OF ISOLATION CUBICLES IN HOSPITAL WARDS AND BARRACKS[1]

In our new base hospitals, and even in some of the sleeping rooms for enlisted men in our cantonments, one will frequently see a device which has proven to be very effective in isolating patients with respect to disease germs sprayed about by irresponsible, indiscriminate coughing and sneezing, and in protecting the sleeping soldier from this mode of infection.

It is very simple, being, in effect, merely a sheet swung upon a block and tackle arrangement between the beds. Like every other wrinkle in sanitation, this device has a little history of its own, "whereby hangs a tale" going back to the days of the three great physicians who presided over the wards of the Hôpital des enfants malades (Paris). When, in 1878, these wards came under the celebrated Parrot, the former chief at the Enfants' Assistés, they were in the worst possible shape. Isolation was a farce, consisting merely in the juxtaposition of infected infants in a closed space. Parrot himself, a pathologist by instinct and training, cared most for the autopsies he made upon dead infants in support of his theory of "athrepsia" and his studies of hereditary syphilis. About five hundred infants died and were autopsied annually in these wards. Parrot believed that this mortality was largely due to a mysterious underlying marasmus, or "athrepsia," the symptoms of which were singularly like those of an infectious disease. Meanwhile, his wards were dark, gloomy, dirty—the sick infants crowded side by side, the same half-dirty spoon serving for the examination of all throats, the same thermometer serving for all rectal temperatures, the mattresses soiled with dejecta; the infants fed by dirty appliances in dirtier hands. What Parrot thought to be a special "morbid entity" was in reality the result of measles, diphtheria, scarlatina and various toxic infections of the alimentary tract. When Grancher succeeded Parrot, in 1885, the ideas of Pasteur were gaining ascendancy, and the day of a new order of things was at hand. Parrot had seen things mainly from the viewpoint of a coroner with certain pet theories of pathology, but Grancher was essentially a hygienist in his instincts.

In 1888, Grancher had attained to complete surgical cleanliness of his wards by sterilizing all spoons, forks, goblets and other utensils, as well as the floors and walls, by requiring the nurses to wear a special blouse whenever they approached infected infants, and by

[1] With five illustrations.

FIG. 1.

FIG. 2.

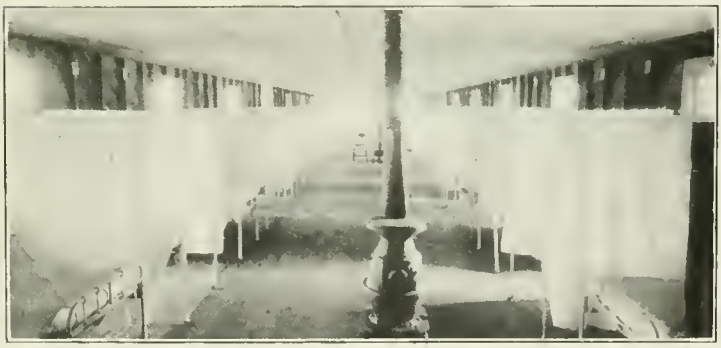

FIG. 3.

To face page 700.

FIG. 4.

FIG. 5.

protecting the latter from one another by covering the bed with a movable grill or lattice-work screen, which was only removed when it was necessary to feed or examine the infant.

This system was in full swing in 1889. In 1894 Hutinel, Grancher's successor, replaced the movable grills by glass boxes (*boxes vitrés*) investing the beds and provided with a doorway entrance. These devices, now in use in many children's hospitals on the Continent and elsewhere, were the originals of the cotton and cheesecloth screens between beds which, for diseases like measles, pneumonia and meningitis, are much simpler, and, like the cloth curtains of our gas masks, more effective for diseases transmitted *via* the air passages—Fielding H. Garrison.

The following description, with five illustrations, of the application of these principles to our military hospitals is reported by First Lieut. Nathan S. Schiff, M. R. C., U. S. Army:

An important and often difficult problem of the proper conduction of a military base hospital, especially under the stress and duress of epidemics such as have been raging in many of our camps, is proper sanitation, and prevention of the occurrence of reinfection in hospital.

This article is intended to present a simple and ideal method for the preparation and conduction of the various wards, especially those containing cases of acute diseases. These wards are sub-divided into an office, main room, linen room, sink room, kitchen, ward master's room, and latrine, which is connected to the side of each ward.

We shall confine ourselves to the proper care and sanitation of the ward in particular, the isolation of patients by means of cloth screens between the beds, and the collection of infected spots for destruction.

Construction.—Ordinary clothes-line wiring is strung across the ward as shown in Fig. 1, drawn taut by means of a "block and tackle," and held in position by eyescrews which are fastened to the sides of the building 6 feet 3 inches above the floor and 5 feet 3 inches apart, giving ample room between same for a regulation army bed and a small table as shown in Fig. 2. These divided spaces are numbered 1, 2, etc., up one side of the ward and down the other as shown in Fig. 3.

The tables are 15 inches by 17 inches and the tops are covered with white oilcloth which is cut to measure and held in position by means of tacks. These tables are arranged at the right side of the bed and contain only an individual drinking glass, sputum cup and paper bag, the paper bag being attached to the table with two slips of adhesive. The sputum cup consists of an outer metal frame and an inner paper cup (Seabury's sanitary sputum cup). The table is also numbered, corresponding to the number and position of the bed.

The beds, besides the usual blankets, sheets, etc., contain a roll of

toilet paper which is attached to the outer wiring of the spring on the right side of the patient by means of a twine passing through the center of the roll in such manner as to allow free rotation. At the foot of each bed is attached a numbered piece of adhesive, corresponding to the number of the table and of the space allotted to the bed. There is also attached to the foot of the bed a slip of paper containing the name of the patient, date of admission and diagnosis.

The sheets are ordinary bed sheets so placed across the wires that there is an overlapping of about 8 inches and which are held in position by a few pins. In the rear of the ward a sufficient number of sheets are placed in the same manner as to completely separate the ward into two parts. The latter sheets reach to the floor, the edges being inverted toward the smaller division of the ward and tacked to the floor. The adjoining sheets are also connected by pins except in one place which is used as a means of entry. The smaller part of the ward so isolated is arranged in a similar manner as before mentioned and is used as an isolation division where suspected infectious cases, *e. g.,* streptococcus, hemolyticus, throat infections, etc. Rigid isolation is initiated when necessary and a placard is fastened to this sheet, facing the larger division of the ward and reading, "Positively no admission." One nurse and one ward man are assigned to the care of these cases and especially informed as to asepsis, etc.

Method of Operation.—When admitted, a patient, if coughing, is warned never to do so without first covering his mouth with paper torn from the roll as described above. When coughing has subsided, he then crumples the paper and throws it into the bag attached to the adjoining table. All other waste matter must also be thrown into this bag. These bags are collected daily and burned in the ward stove, together with the paper sputum cups before mentioned. Fresh bags are attached each morning after the table tops have been washed with a cresol solution.

In unfavorable weather the sheets are drawn from the head to the foot of the bed as shown in Fig. 3, thereby separating the ward into forty or more separate and distinct rooms. In favorable weather, in all cases except those contraindicated, the beds are removed to the porch. (Fig. 4.) This is done in steps as follows: (*a*) The sheets are drawn back as shown in Fig. 2. This procedure takes about two minutes. (b) The beds are then wheeled out with the individual tables. It takes two men approximately fifteen minutes for this procedure. The tables are arranged to the right of each bed as described heretofore, the ward then appearing as in Fig. 4. Two orderlies and a nurse are in constant attendance.

No unnecessary articles, as clothing, shoes, etc., are permitted about the beds. Overcoats and other personal property, except bathrobe, slippers and towel are placed at one end of the ward as shown in Fig. 5 with identification slips in each coat and with the numbers on the

wall corresponding with the numbers on the patients' beds. To prevent the exchanging of clothing and other difficulties, convalescing patients are prohibited from handling such clothes without the permission of the ward master, as is designated by placard on the wall as shown in Fig. 5. A board containing the names of patients (see Fig. 5) is kept on the wall, the number appearing opposite the name corresponding to the position of the bed, bed number, table, sputum cup, glass and the clothes hook number of the individual.

The following rules of sanitation are observed: (*a*) Kitchen floor and hall mopped after each meal; (*b*) ward mopped daily; (*c*) ward swept with cresol solution after each meal; (*d*) bed posts cleaned with cresol every Monday, Thursday and Saturday; (*e*) sheets between beds to be drawn down to the foot of the beds at all times; (*f*) sputum cups to be burned daily; (*g*) paper bags to be changed daily and burned; (*h*) keep kitchen and washroom sinks clean; (*i*) clean icebox inside and out daily; (*j*) garbage pails to be covered at all times and emptied after each mess, at which time they are to be scrubbed with a cresol solution.

The day force consists of a ward surgeon, three nurses and from four to six orderlies, and the night force, of an officer of the day, one nurse and one orderly. Each ward is so arranged to accommodate thirty-two patients, but can in emergencies care for forty-two without inconvenience.

Conclusion.—The complete isolation of each patient, the preventive measures taken against the dissemination of infected sputum as described above, the paper and bag arrangement, the removal of waste and infected excreta by burning, keeping the ward free from all unnecessary articles, restricting each patient to the same articles from time of admission to time of discharge, the absolute airing and sterilization of bed, bedclothing, etc., by the direct rays of the sun while the beds are on the porch, the complete airing of wards and the flooding of same with the rays of the sun when the beds are removed and the sheets drawn as shown in Fig. 3—all lessen the chances of reinfection and spread of disease to a minimum. The removal of beds and tables from the ward, as shown in Fig. 3, make it possible to cleanse every nook and corner.

The isolation arrangement in the rear of the ward tends to prevent the entire ward from being quarantined, as suspected cases are immediately removed to the isolation division and the suspects are also isolated from each other by the short sheets before mentioned. As soon as a positive diagnosis is made, the case is removed through the rear door and sent to the general isolation ward. The sheets, beds, etc., are then sterilized. This arrangement, as can readily be seen, also tends to minimize the dangers of reinfection.

A SIMPLE, AUTOMATIC, NON-INFECTING COVER FOR A PIT PRIVY[1]

Notwithstanding the fact that "whatsoever thing from without entereth into the man . . . goeth out into the draught," and always has done so, if the man is to live, nevertheless we have not yet devised a thoroughly satisfactory way of disposing of the "draught" in great aggregations of people, especially in armies. This fact is evidenced by the multitude of schemes that are presented for consideration, most of which are simply reincarnations, so to speak. The following suggestion by Capt. Ivan I. Yoder, M. R. C., so far as we are aware, has not yet appeared in our books on military hygiene.—Editor.

Captain Yoder writes:

In a study of designs and appliances used for latrine covers, one finds that most of the effort has been made to find something that is simple, economical and fly-proof. At the same time it is noticeable that little attention has been paid to personal cleanliness and the natural inclinations in army life.

All the different arrangements for support by rail or hole have the same objections in that they are generally soiled with urine and feces where contact is made with the clothing, and always with the body itself. Careful cleansing of rail or seat, once or twice daily, will not obviate this disagreeable fact. Even where one prefers to use the modern toilet, he will select the open accommodations when the toilet is too cosmopolitan.

The natural and physiological attitude for defecation is the squat-straddle position. That it is also the most desirable and effective is attested by the constant tendency of the soldier, in all camps, to go to the bushes and cornfields when the orders to the contrary are not too stringent.

A latrine must serve the needs of general sanitation and should contribute to personal cleanliness; it must be simple and portable and should be economical and easily cared for.

The latrine cover here proposed combines all these points.

In Fig 1[2] is shown a model which is easily constructed, with simple materials, but which is not intended to be portable. Close packing is prevented by the projecting upright pieces *A*, which do not collapse in this model.

This model is shown with only two holes, to accommodate two men, with a double lid for each man. It can be constructed to cover the

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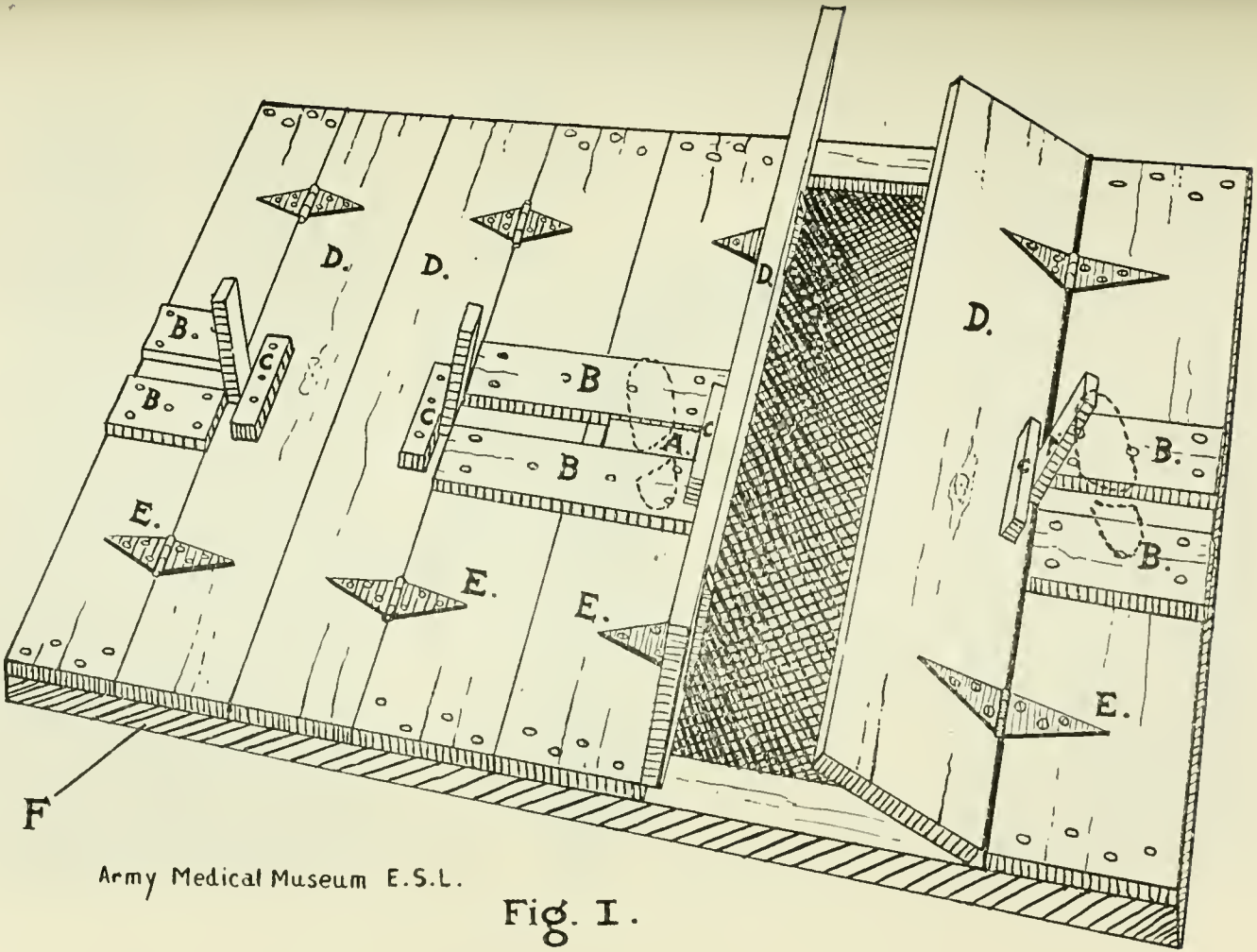
[1] With six illustrations.

[2] This is a sketch of second model constructed at Co. No. 10, M. O. T. C., Fort Benjamin Harrison, Ind., November 1, 1917. The original photographs were lost by the photographers.



Army Medical Museum E.S.L.

Fig. I.

same sized trenches as the Havard box, with from one to eight or ten holes. Each hole is a straddle trench, at right angles to the long trench underneath, with a double lid which closes tightly and automatically. One approaches the latrine cover from either side, stands on one of the *E* boards, balances on one foot, while the other foot pushes down the opposite upright *A* and stands on it and *BB*. This will open one lid and retain it. The other foot then turns down the other upright *A*, and likewise holds it down. This gives the position shown at the right end of Fig. 1. The occupant then squats, without resting any part of body on latrine cover. No separate urinal is necessary. In this case the standing position can be retained.

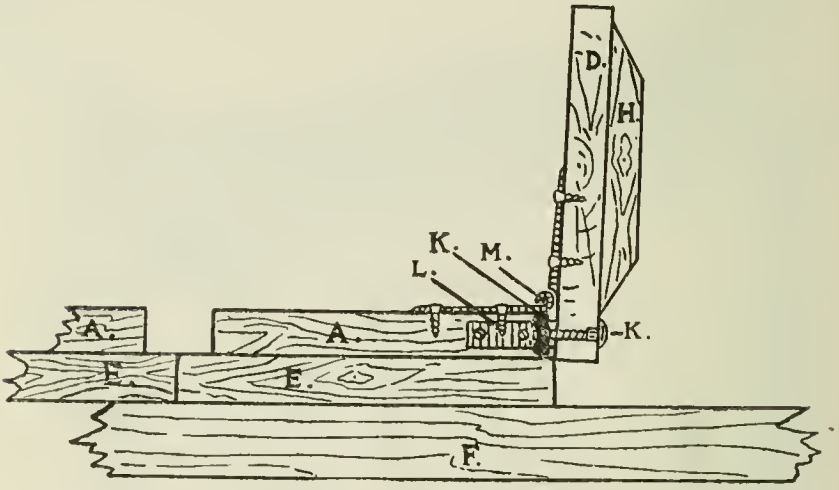


Fig. II. Army Medical Museum E.S.L.

In Fig. 4 is shown a collapsible and take-down model. The upright *A*, instead of being nailed to *D*, as in Fig. 1, is screwed or hinged to *D*, as shown in Fig. 2. In order to hold this upright erect, and to prevent the lid *D* from passing beyond the near perpendicular when it is swung open with the foot, a small piece of bent strap-iron is screwed to the base and at side of *A* and the flange secured to *D* with a screw or thumb-nut *K* as shown in Figs. 2 and 4.

Four 2 x 6-inch timbers are placed around the trench and secured with a stake at each corner, as shown in Fig 6. Each of these timbers should project 2 inches over the edge of the trench, at its four sides, and leave 4 inches in width all around for good footing on the ground. These should be 26 inches apart between long pieces; the distance apart of short or end pieces depends on length of trench desired. The trench should be 26 inches wide.

On the under side of each section *DEED* (shown entire only in Fig. 1), and at each side of trench, is secured a small piece of wood *P*, about 1½ inches by 6 inches, which fits into a cut-out notch in *F*, as shown in Fig. 4. This holds the different sections in alignment and enables one to lift each section for inspection, cleaning, or when transporting. The board strips *O, O, O, O*, each 6 inches by 10 inches, are nailed to under side of *EE* (Fig. 4). They aid in alignment and secure greater stability to section *DEED*.

Strips *BB*, Figs. 1 and 4, are about 12 inches in length and 3 inches in width; are nailed on top of *EE*, and are separated enough to allow *A* to lie between when lids *DD* are opened. These strips give security to the section and form part of the platform when in use.

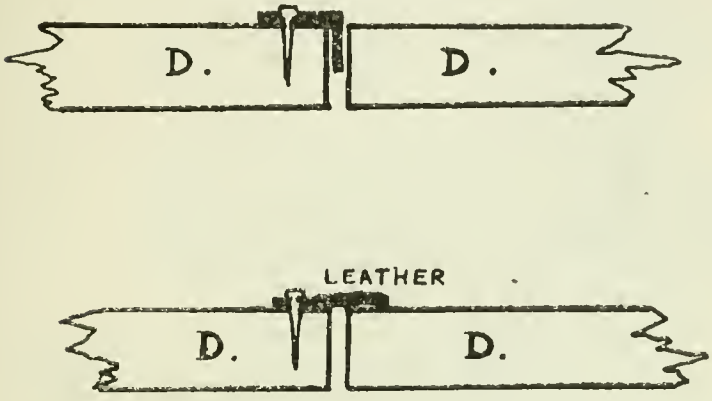


FIG. III.

Army Medical Museum E.S.L.

Three-quarter-inch material is heavy enough to use in the superstructure. Each lid *D* is 2 feet 4 inches long by 6¼ inches wide, and is strengthened and weighted at each end with wooden non-warping strips, *H*, screwed underneath. These should just clear the 2 by 6, or be one inch from each end of *D*. This gives the lids a lap of one inch over frame at each side. The width of *EE* is 13 inches.

The uprights, *A*, *A*, are 5½ to 6 inches long and about 2½ inches in width. These do not stand quite perpendicular, but approach the lid *D*, at its hinge edge, at an angle of about 95 degrees. This will permit the lids to lean towards each other, somewhat, when in use, and assist in cleanliness and more positive closure. The thumb-nut *K* comes into use only when it becomes necessary to pack and transport the latrine cover, at which time it is loosened, the piece *A* bent to *D*, on its hinge, the nut is replaced, without the aid of tools.

As above described, the lids, when open, will clear about 9½ inches in width and 2 feet 2 inches in length. It has been found that a lid 6¼ inches wide, when raised, will give a clearance from the body of from 1 to 2 inches. The first model constructed had a raised platform, but this was found to be unnecessary. Any amount of clearance of gluteal region from edges of open lids desired may be obtained by raising strips *BB* on a platform and securing uprights *AA* at a distance farther away from hinges on lids, so that it will always lie between, and at the same level, as strips *BB* when lids are open.

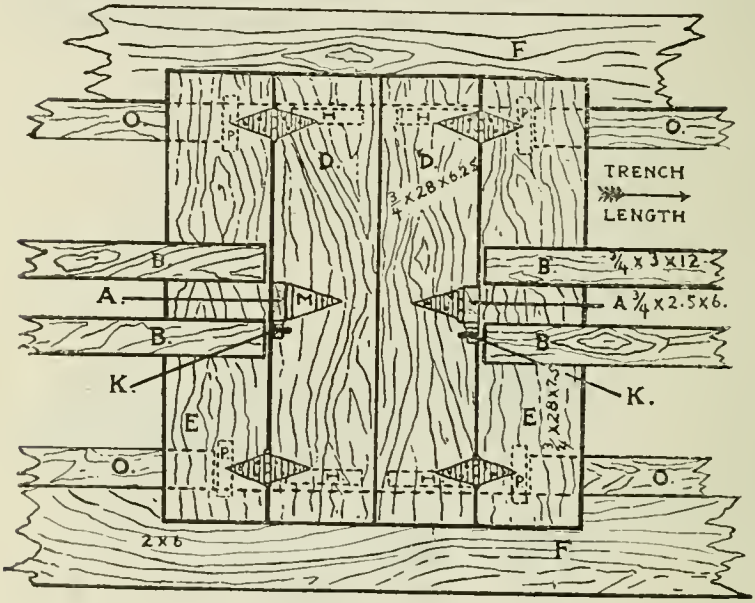


Fig. IV. Army Medical Museum E.S.L.

The mechanical principles involved are shown in Fig. 5. The upright *A* is not shown here, since the section is taken through a hinge holding *D* and over brace *H*, on the under side of lid *D*. This upright acts as a lever with its fulcrum at hinge-joint. The center of gravity of lid is so far to the right of hinge-joint, that the lid falls, like the self-closing lid in the Havard box, and carries the small upright *A* to its near perpendicular.

In transportation, the latrine cover shown in Fig. 4 will pack in space 4 inches in height, when moved with frame attached, or 3 inches if loose. It can readily be seen that this construction will support the heaviest man, will permit easy transportation and economical storage,

needs comparatively little lumber, is simple in construction and operation, and offers a means of physiological defecation with all sanitary precautions.

It is suggested that crude oil and lamp-black or some similar mixture be sprayed over top of cover as well as underneath and into pit. The feet, only, touch this cover, and there is no occasion to contaminate the clothing, body or hands.

When spraying with oil or inspecting, it is only necessary to raise lids with feet as when in use. If trench is to be burned out, each

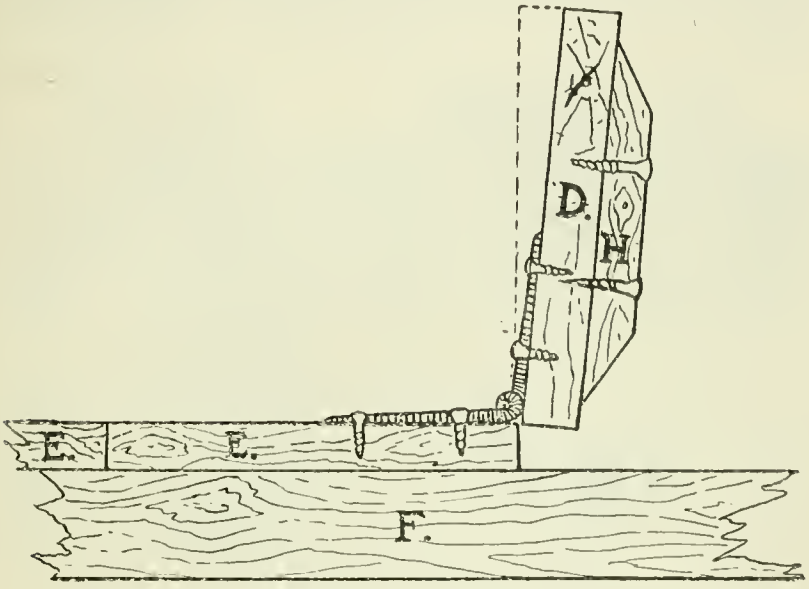


Fig. V. Army Medical Museum E.S.L.

section (*DEED*) can easily be removed and laid aside, and again replaced.

If shrinking of the wood should separate the lids *DD* too far and entrance of flies is suspected, recourse may be had to strips of leather or some similar fabric, nailed on upper edge of one of the lids, as shown in Fig. 3. The upper figure shows where the left lid fell first, and the lower figure where the right lid fell first. In each case there is complete closure.

Some criticism may be invited by the size of opening and apparent easy access of flies given by the lids when in use.

If the habits of the fly are observed closely, it will be noticed that the fly never goes to its intended food on its first trip, but alights near

by, apparently takes a second look, and then approaches it on foot or on a second trip, awing. It is the writer's opinion that the oil and lamp-black mixture will prevent, almost entirely, the entrance of flies into this opening. A fly, as is well known, despises oil and shuns black colors. The lids are covered with both and the fly will not go directly into the hole. The fly may alight on the one using the latrine, but here it becomes at once a matter of comparison with other forms of latrine covers.

This cover should be ideal for use with mobile troops, where the old straddle trench is used; in this case section *EDDE* is joined end to end with another section of *EDDE,* in series, instead of side by side, as illustrated.

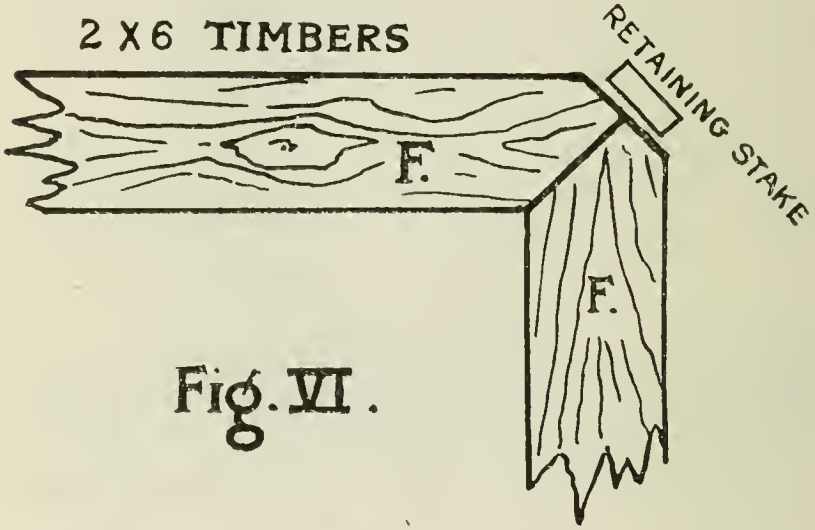


Fig. VI.

Army Medical Museum E.S.L.

This latrine cover could be easily adapted to use in the trenches. In this case a single section, as *EDDE* (Fig. 4), could be fitted over a box in which is a removable metal pan or trough. This metal pan, 2 feet 2 inches long, by 14 inches wide, by 8 to 12 inches deep, should fit up against the latrine cover and have a fitting, for a bevelled lid of metal, to cover pan when full and for protection when in transport to disposal plant. If it is undesirable to allow urine to mix with feces, arrange two joining pans, with tin bridge, underneath latrine cover.

It is again worthy of notice that no part of this latrine cover touches, at any time during defecation, hands or any clothing but the soles of the shoes.

In the March number of THE MILITARY SURGEON, attention was called, by Major Lucas, to the spread of body lice by means of the latrine. In this device no clothing need touch latrine or its cover, and no part of latrine cover rests against body; by the use of this cover the latrine ceases to be a factor in the louse question.

If there is any ground to the contention that venereal disease may be contracted in latrine contact, then surely this latrine cover would be a positive prevention, besides affording better personal cleanliness.

The writer is indebted to Colonel Morse for use of tools and for generous supply of lumber, and to Major Darby for his personal interest and courtesy.

ILLUSTRATIVE CASES OF NEURO-CIRCULATORY ASTHENIA[1]

Through an error, the author of the "Report on Neuro-Circulatory Asthenia and Its Management," which appeared in the April issue of THE MILITARY SURGEON, was given as Dr. Thomas Lewis; the illustrative cases were omitted. Dr. Lewis was kind enough to write the foreword preceding the introduction, but the body of the paper and the case histories here published were the collaborated work of the following six officers of the Medical Reserve Corps, U. S. A.; Capt. B. S. Oppenheimer, 1st Lieutenants Samuel A. Levine, Rufus A. Morison, Marcus A. Rothschild, William St. Lawrence, and Frank N. Wilson. These officers were detailed, with the approval of the Surgeon General, U. S. A., to the Military Heart Hospital at Colchester, England, and they take pleasure in thanking the Royal Medical Research Committee, including Dr. Lewis, for the privilege of making liberal use of the records of the hospital.

APPENDIX OF ILLUSTRATIVE CASES OF NEURO-CIRCULATORY ASTHENIA

The purpose of the following cases is threefold. They illustrate the various modes of onset of the symptoms of Neuro-Circulatory Asthenia, and the predisposing and precipitating etiologic factors. In addition they serve as examples of routine case histories and describe the clinical findings. Finally, they indicate how the tolerance to exercise is used in determining the category of duty of which a patient is considered capable. In four instances it is possible to add the subsequent history of the patients several months after their discharge.

[1] In suggesting the name Neuro-Circulatory Asthenia ("N. C. A."), the authors emphasized that no theory as to the underlying pathogenetic process is implied; it is a practical, convenient term to apply to a well-defined syndrome in which certain nervous and circulatory symptoms are associated with an increased susceptibility to fatigue.

1. *Constitutional Type*

Summary.—Has never been able to play games or do hard work because of shortness of breath and general weakness. Has been in the army two and a half years, but has been of very little military service; in hospital continuously for past six months.

No. 32868.—Aged 29. Flagman on a railroad.

History.—Did not care for games when young. No history of rheumatic fever or any other serious acute illness. Has never been able to do more than light work because of dyspnea, precordial pain and weakness. The family history is negative.

Training.—Seven months; could not do route marches on account of dyspnea and precordial pain.

Service.—Was sent to France, February, 1916, and was put on light duty as assistant to veterinary sergeant, and continued to have the symptoms of which he had complained before enlistment and before training. He was gassed April, 1916, and all symptoms were aggravated. Was sent into hospital with "D. A. H."[2] Has done very little light work since, frequently reporting sick. Since June, 1917, has been in hospital continuously for five months.

P. E.—A pale, apathetic individual, who looks played out; examination essentially negative, except for an increased heart rate of 120 at rest. The heart shows no hypertrophy, arrhythmia or diastolic murmur. There is a definite blowing systolic murmur at the apex, louder with the patient in the recumbent position. Patient perspired freely during the examination in a cold room; pupils dilated, and there was a definite tâche on mechanical stimulation of the skin. The urine shows no sugar or albumen. The pulse rate went from 120 to 150 after walking up forty steps, and was 136 two minutes later.

Patient could not tolerate the 30-minute exercises or longer route marches because of shortness of breath, dizziness, precordial pain and exhaustion, and after being in the hospital seven weeks was *discharged* fit for *sedentary military duty* (category III).

2. *Advanced Military Age Type*

Summary.—Previously fit. Aged over 40, and unable to stand the strain.

No. 7236.—Aged 42. Regular in Royal Navy.

History.—Has always been well. In the navy practically up to the time he joined the army. Has had no infectious diseases. Quite fit when he joined the army. Eleven months' training in England, with no marching and little exercise. On the first march of 6 miles he fell out with breathlessness and giddiness, also pain over precordium. He was sent to France three months later, and after a short time in the

[2] D. A. H., *i. e.*, disordered action of the heart.

trenches had great breathlessness, fainting and giddiness. Then invalided home.

P. E.—Well nourished. Clammy hands and feet. Heart not enlarged. Apex beat diffuse. There was a systolic murmur over the pulmonary cartilage. Pulse regular, 76. Cyanosis of arms up to the elbows. After the 15-minute exercise, pulse 88 and respirations 36. He appeared greatly distressed. Gradually able to do the 30-minute exercises and route marches with a pulse of 108 and with very few symptoms. *Discharged* for *full duty* category.

Subsequent history.—One year later he was declared permanently unfit for military service.

3. *Rheumatic Fever Before Enlistment*

Summary.—Has had three definite attacks of acute rheumatic fever before enlisting, and for many years has not been able to do heavy work. Has been in the army 18 *months, but has done mostly light duty.*

No. 8798.—Aged 35. Grocer's assistant.

History.—Played games at school, and was well up to the age of 17, when he had *rheumatic fever*. Had a second attack at 22 and the third at 32. Was sick abed with each attack, and has never felt the same since the first attack. He had to give up farm work after the age of 28 because of weakness, dyspnea and palpitation. No other acute illnesses.

Training.—Nine weeks, but did no route marches and could not carry a pack.

Service.—Did light orderly duty for first year in England. To France March, 1917, but was boarded "P. B." (permanent base). He went up the line, however, to do salvage work for eight months. He fainted on three occasions, and the shortness of breath grew much worse. He was never buried, gassed or wounded, and never had trench fever. He finally had to be sent back to England.

Main complaints.—Precordial pain, dizziness and shortness of breath.

P. E.—Essentially negative throughout, except for a soft systolic murmur at the apex and an excessive heart rate at rest, 132, which rose to 156 after climbing forty steps; hands were cyanotic, warm and tremulous. Urine showed no sugar or albumen. Patient did the 30-minute exercises and longer route marches, but with some difficulty, and was *discharged fit for light or home duty.*

4. *Rheumatic Fever After Enlistment*

Summary.—Always well until he had rheumatic fever, May, 1916, during active service; has been short of breath and weak ever since.

No. 20989.—Aged 26. Apprentice boilermaker.

History.—Very active when young; played games without any difficulty. No previous illnesses.

Training.—Did not need any, because he was in the service before war broke out.

Service.—Enlisted in the Royal Navy, January, 1911, and served without any trouble until he developed *rheumatic fever,* May, 1915. Was sick for 5 months, and was invalided home. In 1916 he was called up and considered fit for full duty, although he was troubled with dyspnea on exertion and palpitation ever since convalescing from the rheumatic fever. Went to Serbia, and carried on in spite of weakness and shortness of breath for a few months. Had to fall out in marches. Finally invalided home. After 3 months, was sent to France into the trenches; over the top twice. Fainted frequently, and finally was sent home.

Main complaints.—Shortness of breath, palpitation, pains across left chest and dizziness.

P. E.—Patient seems very tremulous and exhausted. Heart shows no enlargement or significant murmurs. Rate is 150 and rises to 180 after walking up twenty steps. Teeth showed marked pyorrhea alveolaris; there was a marked coarse tremor of the hands, the face was pinched, and during examination there was excessive perspiration. Urine was negative. Patient fainted several times in the hospital, could not do the 15-minute exercises, and was *discharged* as *permanently unfit.*

5. *Following Trench Fever*

Summary.—Well before enlistment and during training. Carried on for three months in France. Trench fever: not on full duty since.

No. 220964.—Aged 19. Insurance agent.

History.—Health good as a boy. Went to school until 13, and played cricket and other games without symptoms. Did light work from the time he left school until enlistment, and had none of the present symptoms up to that time. Never had rheumatic fever, growing pains or chorea. Had tonsillitis frequently, and tonsils were removed at 15.

Training.—Enlisted February 8, 1917, and had 5 months' training. Artillery training without route marches and only light work. No symptoms during training. To France, June, 1917; was with an 18-pound gun, 1 to 1½ miles back of the trenches. Was slightly gassed on one occasion, but did not go off duty. Never wounded or buried. Carried on without difficulty until August, 1917, when he had *trench fever.* He was in hospital five weeks, and has not been well since. He began to be troubled with shortness of breath, weakness, headaches, and precordial pain as soon as he got out of bed, and has never been on full duty since.

P. E.—Examination was practically negative, with these exceptions: Marked tremor of the hands, faint systolic blow in the pulmonary area, a diffuse apex beat and exaggerated knee jerks. The pulse rate was 88,

at rest, increased to 160 after exertion (walking briskly up forty steps), and 116 two minutes after the cessation of the exercise. The patient tolerated 30-minute exercises well, and was *discharged in light or home duty* category after being six weeks in the hospital.

6. *Following Infection—Bronchitis*

Summary.—Was always a fit man, and served almost two years in the army on full duty until he went sick with bronchitis, since when he has had dyspnea, palpitation and giddiness.

No. 14967.—Aged 21. Motor body builder.

History.—Played games at school without any difficulty. Work as a motor-body builder was fairly hard, but had no trouble with it. Never had rheumatic fever or any acute illness. Family history is negative. Considered himself a very fit man before enlistment.

Training.—For seven months without difficulty.

Service.—Sent to France, June, 1916. Put to work repairing aeroplanes behind the lines, and continued at this work until he reported sick, October 5, 1917. Was never wounded, buried or gassed, and never had trench fever. In the beginning of October, 1917, he developed a cough, and found that he grew short of breath on exertion and was giddy at times. The diagnosis in the field hospital was *bronchitis* and D. A. H.

Main complaints.—Shortness of breath, palpitation and giddiness.

P. E.—Essentially negative throughout. Patient was very well developed. The heart not enlarged, and there was no diastolic murmur. Heart rate on admission was 130 at rest and 156 after walking up forty steps. Hands were blue and shaky. His condition improved strikingly, so that after five weeks of graded exercise he was able to do 30-minute exercises and route marches without difficulty. He was *discharged* fit for *full duty.*

7. *Following Infection—Diarrhea*

Summary.—Fit on joining. Developed diarrhea at the Dardanelles. Invalided to England. Doing light work 19 months later.

No. 02984.—Aged 23. Clerk.

History.—No history of rheumatic fever, chorea, tonsillitis; always healthy. Played football at school. He was quite fit when he joined the service. Nine months' training in England with no symptoms. Went to the Dardanelles in August, 1915. In October, 1915, had diarrhea for ten days, followed by general weakness. In November invalided to Malta for general debility. He then began to complain of pain along the costal margin. Some time later he developed palpitation, marked giddiness, and some shortness of breath and sweating.

P. E.—Well-nourished and muscular. Heart—Apex beat in the fifth space, not enlarged; sounds clear. Pulse, 52. A polygraphic tracing showed no disturbance of mechanism. Blood pressure, 124. Urine ex-

amination negative. He tolerated exercises fairly well, doing 30-minute exercises with a pulse of 104, complaining of fatigue, pain, vertigo, and palpitation. *Discharged* for *light or home duty.*

Subsequent history.—One year later his condition had sufficiently improved so that he was placed on full duty home service; seven months later on light duty.

8. *Following Burial*

Summary.—Absolutely fit on joining the service. The symptoms followed burial and shell-shock. One year later unable to do full duty.

No. 1798.—Aged 20. Light sedentary work.

History.—Patient was quite fit on joining the service. No past history of rheumatic fever, tonsillitis or chorea. Played football and cricket; often ran 5 miles for exercise. Work before joining was light.

Training.—Ten months' training; never ill and never fell out. Developed influenza in France. Complete recovery; no symptoms. Three months later was knocked unconscious by a shell which burst near him and he was buried; ever since has had shortness of breath on slight exertion, palpitation, giddiness, and exhaustibility.

P. E.—Well-developed and nourished. Heart not enlarged. Diffuse pulsation in the fifth space. There is a soft, blowing systolic murmur at the apex. Systolic blood pressure, 132 mm. mercury. Pulse, lying, 100; standing, 142. Urine negative. The rest of the physical examination is essentially negative. He tolerated exercises very poorly, reaching only the milder 30-minute exercises, with a pulse of 140, complaining of fatigue, pain, palpitation, and dyspnea. *Discharged* for *sedentary duty.*

Subsequent history.—Six months later sent overseas on full duty. However, could not carry on, as very nervous. Now assistant in cookhouse.

9. *Following Emotional Shock*

Summary.—Perfectly well up to the time he saw five men killed quite near him by a shell. Symptoms ever since. Ultimate discharge.

No. 2068.—Aged 41. Florist.

History.—Three and a half years in the army. Patient was quite fit on joining; no infectious or venereal diseases. Joined the army in 1913.

Training.—Stood his training with no difficulty. Went to France in 1915. No symptoms until December 19, 1915, when he saw five men near him killed by a shell; he was not injured. From that day he began to be nervous and frightened. He suffered from shortness of breath and pain in the region of the sixth left costal interspace, induced by excitement or moderately heavy exertion. He also became giddy on excitement or stooping. He reported sick in January, 1916, and was

put on light duty till the end of May. There was some improvement; he was again put on heavy duty, and rapidly became worse, and was invalided home in August, 1916.

P. E.—Well-developed and well-nourished. Heart—Apex, fifth space, nipple line, no enlargement by percussion. There is a soft, blowing, systolic murmur at the base. Blood pressure, 132/74. Pulse, 80. The rest of the examination was negative. He was not able to tolerate 30-minute exercises because of a marked exaggeration of all his symptoms. *Discharged* for *sedentary duty.*

Subsequent history.—Four months later was acting as company storeman. Nine months later was discharged from the army.

10. *Following Gassing*

Summary.—Perfectly well previous to enlistment and during training. Carried on in France two and a half months without difficulty. Gassed. Severe precordial pain, dyspnea, and palpitation. Discharged as permanently unfit.

No. 24253.—Aged 24. Clerk.

History.—Perfectly fit previous to enlistment. Played cricket and rode a bicycle without symptoms. Gives no history of rheumatic fever or any serious illnesses.

Training.—Enlisted January 24, 1916, and had twelve months' training in England; during this time he was perfectly well. He went to France, February 13, 1917, and carried on at the front without symptoms until he was *gassed*, on April 29, 1917, since which date he has been constantly in hospitals, complaining of dyspnea, palpitation, precordial pain, and general shakiness. The patient also complains that he has been unable to concentrate on work requiring mental effort since his illness began. Before enlistment he was a clerk, and could do ten or eleven hours of continuous work without excessive fatigue, but at the present time he is completely exhausted at the end of three or four hours.

P. E.—On examination, the patient showed very little that was worthy of note. He was of good physique and healthy in appearance. There was moderate enlargement of the tonsils and the upper teeth were artificial. Thyroiod gland, heart, lung, and abdominal examinations were entirely negative. The urine was normal. There was a definite tremor of the hands and the knee jerks were markedly exaggerated. The pulse rate at rest was 72 per minute. Exercise (walking briskly up forty steps) increased it to 160, and at the end of two minutes it had fallen to 112. This patient was not able to do the lightest physical drills without severe distress. He became very dyspneic and dizzy after exertion, and his pulse rate rose to between 160 and 180. After a prolonged stay at the heart hospital, he was *discharged* unimproved as *permanently unfit* for the army.

11. *Following Wound*

Summary.—Always fit before enlisting; no acute illnesses before or during military service. Carried on in trenches until he was wounded, July, 1916. Has been unable to do heavy work since.

No. 203744.—Aged 25. General laborer.

History.—Was able to play games at school without difficulty. Work in civil life as general laborer was fairly hard. Had no symptoms.

Illnesses.—No rheumatic fever, chorea, or acute tonsillitis.

Training.—For fourteen months. Had no trouble doing long route marches with pack.

Service.—To France, January, 1916; to trenches for six months; over the top once. Never reported sick until he was *wounded* in upper right chest, July 1, 1916. Was in bed for six weeks, followed by six weeks' convalescence. During convalescence first noticed weakness and dyspnea on moderate exertion. Never had dyspnea, palpitation or precordial pain before being wounded. Has not been able to do more than light duty since; he collapsed after one day's hard work. Never was gassed or buried, and never had trench fever.

P. E.—Is essentially negative, except for a slightly increased heart rate of 90 at rest and as fot, blowing systolic murmur at the apex. There was no hypertrophy or diastolic murmur. Urine showed no sugar or albumen. Patient was able to do the 30-minute exercises and longer route marches, but complained of shortness of breath, palpitation and giddiness, and was *discharged* fit for *light or home duty* after six weeks.

12. *Gradual Onset During Active Service*

Summary.—Perfectly well before enlistment and during training. Symptoms began without obvious cause after two years on the western front.

No. 12305.—Aged 28. Laborer in wool warehouse.

History.—Health good as a boy. Went to school until 14 years of age and played the ordinary games without difficulty. Has always done light work. Never noticed present symptoms previous to enlistment. Has never had rheumatic fever, tonsillitis, growing pains, chorea, or scarlet fever.

Training.—Enlisted September 8, 1914. Ten months' training, including route marches with pack, without symptoms. To France, July 13, 1915, and spent 18 months on the front without difficulty. Never gassed or wounded. Did not have any fevers or infectious diseases. In June, 1916, he was buried by a shell, but was very slightly injured and was not off duty. In March, 1917, he volunteered to go to headquarters, where he was engaged in doing carpentering and in working on a pit-saw. This was heavy work, and after three months (June, 1917) he began to be troubled by shortness of breath and dizziness on exertion. These symptoms became progressively worse, so that by

October, 1917, he was unable to continue his duties, and was invalided to England.

P. E.—Examination showed cold cyanotic hands, marked tremor, exaggerated knee jerks and a palpable spleen. Heart, lungs, urine, and general physical examination were negative. The pulse rate in the erect position was 120. It increased to 168 on exertion (walking briskly up forty steps), and was 132 two minutes later. On entrance to the hospital, the patient had considerable distress on light 15-minute exercises, with a pulse rate of 160; but a fortnight later he was able to do 30-minute exercises with very little discomfort and with a pulse rate of 120. He was *discharged* fit for *light or home duty.*

13. *Developing in Training—Made Fit by Graduated Exercise*

Summary.—Was fit before enlistment; developed symptoms during training; made fit by systematic, graduated exercises, and able to carry on in active infantry service.

No. A.6.—Aged 18. Tailor's packer.

History.—Played football and cricket. No infectious diseases. On joining the army he developed shortness of breath on moderate exertion during training. Had not had drills. Has palpitation after exertion or excitement. No giddiness or chest pain.

P. E.—Heart not enlarged. Heart sounds clear at apex. A faint systolic murmur at base. Blood pressure, 132/75. Pulse, 100; after walking briskly up forty steps, 132; two minutes later, 96. Response to exercise very good; at the end of six weeks able to do the 30-minute exercises and route marches with a pulse of 102 and no symptoms. Sent back to his training camp for *full duty.*

Subsequent history.—One year later doing full infantry duty.

CURRENT LITERATURE

The Chlorine Antiseptics in Civil Hospital Use, by John A. Hartwell, M.D., New York. *Annals of Surgery*, vol. lxvii, No. 4, April, 1918, pp. 385-391.

It appears that the last word on the use of the chlorine group of antiseptics has not yet been spoken. Hartwell's conclusions, after four months' intensive study at Bellevue Hospital with the chlorine antiseptics, are:

(1) "The establishment of the Carrel-Dakin technic presents no undue difficulty. (2) The results obtained in the military hospitals abroad can be duplicated in general civil hospitals in dealing with traumatic cases. (3) These antiseptics are not as efficient in controlling spontaneous infections, *i. e.*, those not directly due to trauma. They are not as valuable in burns as other forms of treatment. (4) Reasonable care prevents skin burns in all circumstances. (5) Dichloramine-T in either chlorinated eucalyptol or 'chlorosani'—the chlorinated paraffine oil—is not a completely efficient substitute for the sodium hypochlorite solution."

There seems to be nothing particularly new in these conclusions. Incidentally, it may come as a slight shock to some of the bacteriologists to read that "it has been fully demonstrated that the chlorine antiseptics are not bactericidal to the bacillus pyocyaneus, and burn infection is often contaminated with this organism."

Nor will it, on the other hand, act as a surprise to surgeons to be told that "it was not unusual to find a film of living epithelium extending out over the granulations for a distance of ½ cm. or more without becoming attached to them," and, further, that "in doing grafting and necessary suture it was found necessary to very carefully remove this oily film in order that adjacent surfaces would properly grow together."

H.G. Beyer.

Regeneration of Bone, by Albert A. Berg., M.D., and William Thalhimer, M.D., New York (from the Anatomical Department of Cornell University Medical College). *Annals of Surgery*, vol. lxvii, No. 3, March, 1918, pp. 331-347. With 10 figs.

Although there always remains a wide gap between pure and applied science to be filled up, as there is and must be between our acquired laboratory knowledge of the process of bone regeneration and the practical application of such knowledge to, for instance, the repair of a compound comminuted fracture of a femur, still further complicated by infection, it nevertheless will need no argument to convince us of the fact, that a thorough, accurate, theoretical understanding of

how Nature tries to do her work, is a necessary preliminary acquisition on the part of the surgeon, intent upon doing his best to perform his part with the utmost possible success. Under this impression and from this point of view, we are indebted to our authors for having made a valuable and substantial contribution to our knowledge on the process of bone regeneration.

The short, condensed review of the history given us by the authors through which the problems of bone development and bone growth have passed, from Ollier, through Radzimowsky, Barth, Murphy, Davis and Hunnicut, MacEwen, Mayer and Wehmer, Phemister to Axhausen and the authors; from periosteum and back to it and to the present accepted importance of the osteoblastic cells, lining the periosteum (cambium layer), giving rise to the endosteum, lining the Haversian canals and from which, principally, new bone development proceeds, given a proper bone producing bed, will, no doubt, be read with great interest.

Based upon a large number of painstaking experiments, our authors offer us the following conclusions: (1) Peristeum, devoid of adherent bone cells, when transplanted with foreign tissues, produce bone. (2) Endosteum and osteoblasts, lining Haversian canals, in bone transplants produce bone very actively. (3) The cambium layer, when adherent to transplanted cortex, produces bone. (4) Some bone cells in the transplant are able to persist for almost a year, but most of the bone is absorbed. (5) Fully developed adult bone cells, although they may remain alive for a considerable time, do not reproduce themselves and form bone. (6) Very young lacunar cells (frequently erroneously called bone cells) can reproduce themselves and form bone. (7) Transplanted bone is absorbed not only by osteoclasts, but also by direct action (biochemical?) of growing young bone, and the transplanted bone is replaced either by a creeping forward of the new bone or a gradual extension or expansion of the new bone into the transplant. (8) Marrow spaces and hemotopoietic marrow are formed in the bone which develops from transplanted periosteum. The source of these hemotopoietic cells was not determined. (9) Bone, when is grows into cartilage, does so in the same manner characteristic of the normal embryonic development of endochondral bone, including also epiphysial line formation.

H. G. Beyer.

Identification of the Meningococcus, by Lieut. Col. M. H. Gordon, C.M.G., Royal Army Medical Corps. *Journal Royal Army Medical Corps*, Vol. xxx, No. 1, January, 1918, pp. 1-22.

If any piece of work on the meningococcus, done during this war, will leave its mark on the history of the acquisition of our knowledge of this particular germ, it is that of Lieutenant Colonel Gordon and his associates. Thoroughly scientific in its rudiments, it presses into

practical service the lessons elaborated with a logic that cannot be but conclusive. The recognition of coccus carriers, the early diagnosis of cerebrospinal meningitis and the specific treatment of this dreaded disease ought, from now on, to be reduced to a matter of practical application.

The groundwork of Lieutenant Colonel Gordon was, undoubtedly, that of the very careful, preliminary and painstaking differentiation of the meningococcus from the numerous other cocci contaminating the mouths and throats of patients, leading him finally through a maze of fermentation and temperature tests, to the recognition of the predominating value of specific agglutination and saturation tests. "In view of the work that had been done by Lochmann, von Lingelsheim, Liebknecht, Kutscher, Dopter and Debré, Elser and Huntoon, Raymond Koch, and others from their labors, it was anticipated that the agglutination test would prove of immediate use for the purpose of identifying the meningococcus."

It had, by this time, come to be recognized that the meningococcus showed a positive agglutination when brought in contact with anti-meningococcus serum. The paramount advantage of identifying the meningococcus in nasopharyngeal secretions can easily be imagined when it is realized that the majority of contacts could be returned to duty within forty-eight hours, at a time when military necessity dictated the holding up of no man, unless he actually carried a meningococcus of known epidemic significance.

The first important and fundamental problem to be solved was, naturally, the finding of a sure, specific agglutinating serum. In order to check the results of simple agglutination, the absorption test was used. Meningococci were collected from the cerebrospinal fluid of thirty-two cases of the disease and systematically investigated. The macroscopic method of Kutscher and Liebknecht was employed. "Raymond Koch's discovery that a suspension of meningococci would keep for several months in saline and serve well for agglutination tests, provided it is heated in the first place for half an hour to 65° C., and 0.5 per cent of phenol then added as a preservative, was made use of and all suspensions standardized to contain the same number of meningococci by a turbidity test worked out for that purpose."

The outcome of the investigation was that thirty-two meningococci were resolved into four groups, as follows:

Type	1	2	3	4
Specimens.....	19	8	4	1

It was found that the major agglutinin of each of the four types was univalent and specific.

Put to the test with nasopharyngeal secretions, the ordinary pharyngococci could not be identified with any of the four types of meningococcus obtained from the cerebrospinal fluid of caries. As a reult of the routine adoption of the test, over sixty specimens of meningococcus had been examined by the end of 1915 with all four agglutinating sera and found to be identical with one or other of the serological types.

"For the last two years monotypical agglutinating sera have been in routine use at the Central Laboratory and in district laboratories for detecting the meningococcus both in cases and in carriers with satisfactory results. Meningococci isolated from troops coming from England, Scotland, Wales, Ireland, France, Gallipoli, Australia, New Zealand, Canada and South Africa have been submitted for examination, and in the vast majority of instances relegated with ease to one or other of the four types with a relative frequency as follows:

Type	1	2	3	4
Frequency.....	40%	45%	10%	5%

A discovery of some importance well worth mentioning in connection with serological studies was this, that the sharpest-cut result with the absorption test was obtained with the so-called *first born* agglutinin —the agglutinin that appears first in the rabbit's blood in response to injection of the antigen. The serum from rabbit immunized several months is not, in the author's experience, the best for absorption tests.

To some of his critics the author answers by saying that "the demonstrated success of the quadrivalent agglutination test in practice during the last two years for identifying the meningococcus both in cases and in carriers among the forces is sufficient to dispel these doubts based to a large extent upon theoretical considerations which are extremely insecure from a scientific point of view. Definition of the relationship between pharynococci and meningococci is a matter of research rather than of philosophy; a research, moreover, of a distinctly arduous character."

H. G. Beyer.

The Alimentation of Troops. Proceedings at the session on November 8, 1917, of the Permanent Delegation of the Sanitary Commissions of Allied Countries; Professor Santoliquido, President of the Commission. Office International d'Hygiène Publique, T. ix, No. 12, December, 1917, pp. 1529-1565.

It appears that a French commission, consisting of Commissary Officer Briand, Major Langlois of the sanitary service, and Major Gelcy of the Medical Corps, had been sent to Italy for the purpose of observ-

ing and investigating the methods in practice in that country for the alimentation of troops. This commission on the 8th of November, 1917, met, under the presidency of Professor Santoliquido, and, in the presence of Justin Godart, Under-secretary of State of the French Sanitary Service, to make its formal report.

Major Gelcy, who made the principal report on the occasion, gave a summary of the results of his observations which he had obtained by a careful and detailed study on eight different military units: (1) One unit of the interior, at Rome, subjected to moderate training; (2) one unit of combatants, in the rear, in level country; (3) one unit of combatants in the rear, in mountainous country; (4) one unit at the front, chosen from a regiment on the march; (5) one unit of the front of the first line, on level ground; (6) one unit of the first line in a mountainous country; (7) one naval unit on land; (8) one naval unit on board.

The recently adopted reform in victualling troops in Italy was the result of a reduction of the quantities of meat and bread and of a partial compensation of the implied loss by substituting certain quantities of cheese, fresh vegetables and condiments. A few examples will serve to illustrate how this was effected:

1. For territorial troops the former daily ration had amounted to a total fuel value of 3.013 calories, assured by 146 gms. of proteins; 31 gms. of fats; 517 gms. of carbohydrates. The new ration has a total value of 2,795 calories, supplied by 127 gms. of proteins; 38 gms. of fats; 469 gms. of carbohydrates. The daily bread ration was reduced from 612 gms. to 490 gms; the meat ration from 1,200 gms. per week to 600 gms. (!). The weekly allowance of the remaining ration is fixed at: pies and pastries, 800 gms.; rice, 410 gms.; string beans, lentils or peas, 230 gms.; cheese, 180 gms.; potatoes, 420 gms.; and, finally, condiment, containing per week 62 gms. of oil and an equal amount of lard; lastly, coffee and sugar.

2. For troops at the front and to the rear, the old ration had a total fuel value of 4,062 calories, furnished by 222.4 gms. of proteins; 45 gms. of fats; 669 gms. of carbohydrates. The new ration gives an energy value of 3,006 calories, assured by 165 gms. of proteins; 42 gms. of fats and 469 gms. of carbohydrates. The daily ration of bread was reduced from 750 gms. to 700 gms. and that of meat from 375 to 250 gms. The remainder of the ration consists in a weekly allowance of pastries, 600 gms.; rice, 450 gms.; cheese, 350 gms.; potatoes, 450 gms.; string beans, 160 gms.; fresh vegetables, 400 gms.; preserved condiment, 182 gms.; wine, 750 cc.; finally, a daily supply of 15 gms. of coffee and 20 gms. of sugar. The bill of fare is subject to variation by the substitution of fresh meat, canned meat or dried cod or salmon.

3. For troops of the first line of combatants, the ration permits an extra dose of alcohol in that the men receive 150 cc. of marsala wine or 40 cc. of an elixir of quinine over and above the amount of wine

which is distributed three times a week. The doses of sugar and coffee are frequently doubled during the winter or when the troops are in the mountains. The ration for troops of the first line is, as will be seen, considerably re-enforced, giving a total value of from 3,200 to 3,250 calories, according to season or altitude.

In the Navy, the same as at the front, the food supply is richer than in the territorial army. The regular ration for seamen amounts to 2,977 calories on land and to 3,036 calories when on board ship. For the land forces the meat ration is 250 gms.; the bread or biscuit ration, 520 gms.; for the men on board ship, the meat ration is 275 gms.; the bread or biscuit ration, 570 gms. The weekly allowance of the remaining portion of the ration consists of 670 gms. of pastries; 420 gms. of rice; 340 gms. of dried string beans; 50 gms. of cheese; 50 gms. of mackerel (on Fridays); 142 gms. of oil; lastly, coffee, sugar, salt and vinaigre. The men on land duty receive, besides, 10 centimes, those on sea duty 12 centimes daily for the purchase of fresh vegetables. Nevertheless, our reporter admits, the reduction in the ration is considerable. But, notwithstanding the fact that this reduction in the rations for both the army and the navy of Italy has netted the government a saving of 280,696,800 francs annually we are assured that it was exclusively from considerations for the health and the value of the troops that these reductions were made!

Of the results of the practical application of these modified and reduced rations to the different units of the army of Italy, as observed by the commission, our reporter gives a uniformly satisfactory account, lacking, perhaps slightly, in a way desirable elements of criticism. He lays stress on the all-important fact that the food is of excellent taste, well cooked and served. "Whether it is meat, pastry, vegetables or rice, everything is cooked to a point and fit to be served on any table whatsoever."

These results are due, according to Geley, (1) to the choice of the raw materials which are of the first quality, controlled regularly in the laboratory; (2) to the care which is taken in their preparation in the kitchen, and (last not least) to the function of a permanent supervisory commission, consisting of a presiding superior officer, of a captain, two petty officers, a physician and a commissary officer, under whose orders are placed several petty officers and soldier cooks, all of whom had received a thorough course of special instruction to fit them for their duties; this course is described in detail. An article, seeming to play an essential rôle in the kitchen of the Italian army, is the "*condiment*" and which, according to Geley, is added to every portion, whether it be pastry or vegetables, giving it a most particular and agreeable aroma. This condiment, when made extemporaneously, is made by boiling for 1½ hours, in a given quantity of water, tomatoes, celery, ognons, olive oil and lard, with additions of pepper, salt and sometimes some aromatic substances. When made for the front, it is composed of con-

centrated extract of tomatoes, 25; lard, 10; olive oil, 10; ognon, 15; carrots, 8; celery, 3; beef, 6; salt, 1; pepper, 0.1; bouillon, 10; each pot is adjusted for 40 rations. All the men, without exception, are said to find it exquisite.

The concluding portion of the report of Major Geley is one uniform accord of a general all-round satisfaction with the new ration introduced into the army and navy of Italy; a great satisfaction to General Rho, the chief advocate of it!

During the discussion that followed the reading of the commission's reports, the remarks made by Medical Inspector Limonin on the importance of the bread ration and the possible danger that might follow its reduction have impressed the reviewer. He quoted from some observations made by Médecin-Majeur Abt, who had studied the variation in weight in recruits of the 1918 class with special reference to diet, at the end of two months' military service. He had noted that the principal cause for the variations in the weight of young recruits was in the amount of bread that they consumed. It had been found that those regiments in which the weight had increased or remained stationary, in a proportion above 75 per cent were those in which the mean daily ration of bread was 822 gms.; in the regiments in which the same proportion was inferior to 70 per cent, were those supplied by a mean daily bread ration of 733 gms.; those who weighed least consumed but 607 gms. of bread. Limonin concludes that, for Frenchmen, the figure of 740 gms. appears to be the more rational.

H. G. Beyer.

A Study of Ante-operative and Post-operative Blood Counts in Non infective Surgical Conditions, by Frank L. Meleney, M.D., New York. *Annals of Surgery*, Vol. lxvii, No. 2, February, 1918, pp. 129-148.

"The phenomenon of postoperative leucocytosis which occurs in those cases which have no acute infective process going on, although less frequently observed, should be of interest both to the surgical pathologist and to the operator *who endeavors to minimize the injury of an operation.*" The reviewer, from his own limited exeprience as an operator, would like to underline that portion in the preceding paragraph which concerns the operator. It should never be forgotten that every operation is primarily an injury against which the animal organism will react!

It has been known for some years that a leucocytosis follows operations under anesthesia, the causative factors of which are numerous, and "it is impossible to subject human beings, or even animals, to one factor at a time and observe the results of each . . . it is only by taking a large number of cases which have some one thing in common, that the *highest common factor,* so to speak, can stand out prominently and the individual variations be reduced to a minimum." Such an ultimate analysis the author presents us with in the above paper, amply,

and clearly illustrated by figures and tables. He shows that the leucocytosis following an operation is primarily the result of the operation and, furthermore, that it is essentially a polynucleosis; that infection or contamination has nothing whatever to do with this initial rise. "In the clean cases the count returns to normal on the fourth day; in the borderline cases on the seventh day; in the infected cases not until the twelfth day." Infection, therefore, although it is not responsible for the rise (in leucocytes), does delay the fall. It may now become a generally accepted theory that the outpouring of leucocytes is a reaction to injury.

The author's conclusions are as follows: (1) In surgical cases undergoing operation without infection, the white cells increase in number, and about six hours after operation have more than doubled.

2. The response is due almost entirely to the outpouring of polymorphonuclear cells.

3. There is a trivial rise in red cells after operation, but in the subsequent ten days this is followed by a progressive anemia with an average loss of about one-half million cells per cmm.

4. The white cell count may be expected to fall rapidly in clean cases and reach normal on the fourth day. In infected or contaminated cases, it will fall much more slowly.

5. Infection and contamination have nothing to do with the initial rise, but on the second or third day after operation they will tend to keep the count high.

6. Other things being equal, the count will be higher in those cases in which there are severe trauma to the tissues, many sutures and ligatures used, considerable loss of blood and long anesthesia, especially with ether.

7. Normal individuals will produce a higher leucocytosis than abnormal types.

H. G. Beyer.

The Rapid Recovery from Scarlatina by a New Method of Treatment, by Dr. Cesare Margotta, tenentd col. medico. *Giornale di Medicina Militare*, Anno lxvii, January 31, 1918, pp. 17-24.

In a few pertinent prefatory remarks the author explains that the motive for his recommending a new remedy was not the result of an easy seduction by a novelty but rather his conviction of the fact that he had a sure remedy to offer against a disease that was always insidious and grave, even under the guise of a benign character.

It appears that Professor Alecci, after having experimented with several therapeutic remedies, had finally come upon one for scarlatina to which he had given the name of "*Antiscarlatinosa Alecci*" and the practical use of which, in the hands of all those experimenting with it, had given such constantly satisfactory results as to arouse their unqualified enthusiasm and faith in the remedy.

The starting points in this discovery were the excellent results, obtained by Heubner and Eichhorst with the phenols in scarlatina, further confirmed by Taube and Heubner who had practiced parenchymatous injections with them, made into the tonsils and palatine arches.

Alecci, aiming at producing, after the concept of Ehrlich, a "*therapia sterilisans,*" hit upon a phenol chloride to which had been added quinine and camphor, maintained in solution by a special (?) process of preparation. This remedy is said to come in phials of 1 cc. and is administered intramuscularly into the gluteal region under the usual aseptic precautions. Three injections, at intervals of twenty-four hours, are all that are necessary to effect a complete cure.

The cases cited by the author are all so similar that the simple story of one will suffice to give a notion of the method of treatment of them all.

B. Joseph, infanterist, entered the isolation ward, May 17, 1917, from the military hospital Umberto I., after having just returned from a short leave of absence at his home and which he left with pains in his throat. He presented a typical, generalized scarlatinous eruption; soft palate, palatine arches and pharynx characteristically red; general malaise; some cough; temperature 39.8°. Receives first injection immediately after admission; temperature after a few hours drops to 39°, eruption begins to pale, throat is less red, patient feels better. After 24 hours receives a second injection; temperature falls to 37°; is calm and sleeps all night, eruption and throat continue to improve. A third injection is given 24 hours later; temperature falls to normal, desquamation begins, pain in throat disappears, patient feels perfectly well and enters upon a state of convalescence on the 6th to 7th day after being taken sick.

H. G. Beyer.

Further Observation in the Results of Blood Tranfusion in War Surgery, by L. Bruce Robertson, M.B. (Toronto), Major, C. A. M. C., with a Note by Col. C. Gordon Watson, C.M.G., F.R.C.S. *Annals of Surgery,* January, 1918, p. 1.

From his experience with various methods of blood transfusion in a series of 36 cases of hemorrhage and shock, Robertson arrives at the following conclusions:

1. Many cases admitted in an inoperable condition from severe hemorrhage have been rendered operable by blood transfusion.

2. The largest factor in the causation of the shocked condition, as seen in patients admitted to a casualty clearing station, appears to be the loss of blood, except in case of visceral injury.

3. In two cases hemolysis hastened the death of the patient—in one of those the citrate method was used. The possibility of hemolysis certainly is present, but the danger of its occurrence is slight in com

parison with the danger of operating on a shocked and exsanguinated patient.

4. The results in this series of cases of severe primary hemorrhage may be classified as: Life saving, 22; immediately beneficial but died from infection or operation, 9; no benefit, 3; harmful, 2; total 36.

5. Although the mortality in this series of cases is comparatively high, it must be remembered that all the patients were in a desperate condition and, with perhaps one possible exception, could not have been expected to survive, if the procedure had been withheld.

Colonel Watson fully endorses Robertson's conclusions, saying: "Without doubt transfusion of blood after primary hemorrhage is a life-saving device of the greatest value and enables urgent operations to be successfully performed under conditions otherwise hopeless . . . I feel confident that blood transfusion has come to stay and that, under the stimulus of war and the mass of material war provides, our methods will steadily improve."

H. G. Beyer.

Tuberculosis and Military Organization, by Dr. Arnold C. Klebs. *Naval Medical Bulletin*, Vol. ii, No. 4, 1917. Repr.

The all-important tuberculosis problem in its relation to the military services has recently received a most timely and critical treatment at the hands of our author. The paper is extremely suggestive and full of food for thought. "It can hardly be denied that the tenets of the anti-tuberculosis movement have assumed the nature of a dogma: *i. e.,* an overmastering sentiment which has found expression in a formula." This formula implies the disqualification "from service of every one found tuberculous or suspected by an expert," or some authority will be held responsible for the consequences for nonconformity to the formula.

In connection with this, the author quotes "the significant findings by tuberculin tests, applied to the recruits of the Hungarian army by Franz, which demonstrated the presence of the infection in a vast majority of all the recruits, *i. e.,* nearing the 100 per cent" and "this was one corroboration in the *living* of identical findings in *autopsies of the dead* from all causes made by Naegeli, Burkhardt and others." While these facts are known and have been generally accepted, it is positively surprising to find how little attention has been paid to them.

How, then, it might be asked, in view of such findings, is it possible for anyone to place, for instance, the responsibility for the present appalling tuberculosis situation in France, unequivocally on the negligence of the responsible military and civil authorities for the occurrence of a disease of such a character? How can recruiting officers eliminate the tuberculous subjects, aided by tuberculin experts, and still furnish men for either army or navy. In the language of our author,

"the result may be an army and navy of suspicious cases, or none at all." The medical recruiting officer seems to have but two ways out of the difficulty, namely, either to pass the man appearing, in his judgment, as fit for the service, thus acting independently of the strict regulations, or suspend his judgment, act strictly according to prescribed rules, and reject every suspicious case up to 100 per cent.

To quote further from our author: "the ascertained prevalence of tuberculous lesions among modern populations inevitably forces the conclusion that practically everybody is sometimes temporarily ill from tuberculosis and that a very small percentage of them succumb to it."

"Every practitioner of experience can testify to the fact that the later immunity of such cases was by no means always insured by proper treatment or the hygienic ideals of the propogandists, that is, indeed, often persisted despite every infraction of the rules and under actual hardships and arduous occupation. The science which does not take these things into account is not science but sterile dogma."

The author's recommendations for the formation of a special corps of suspects deserve consideration. Such a corps, wisely organized and ably led, would prove its usefulness in various ways and soon succeed in removing from itself the stigma of physical inefficiency. We are urged to be economical in everything. Why throw away useful, willing human lives, offering their services to the country on trial, because of slight defects and against which they bear in themselves the potential means of immunity? Without in the least underestimating the importance of a thorough physical examination, common sense, medical judgment and a little Aristotelian discrimination should never be abandoned, even in the business of recruiting.

The author's paper should be widely read, especially at this time, when the whole tuberculosis question is undergoing a fundamental revision both for our stricken soldiers as well as civilians. The refreshing breezes of honest, scientific criticism, in an atmosphere of rank dogmas and formulas in process of decay, are most stimulating.

H. G. Beyer.

The Grinding of our Wheat in its Relation to Alimentary Hygiene (Le blutage de notre froment devant l'hygiène alimentaire), by M. E. Maurel. *Bull. de l'Académie de Médecine*, No. 50, Seance du 29 December, 1917, p. 799.

By "blutage," the French seem to understand not only the act of grinding the wheat but also that of separating the "wheat from the chaff," by sifting. Thus they speak of a "blutage" of 74 per cent and one yielding 85 per cent, according as this process is made to yield 74 parts or 85 parts of flour for breadmaking, from 100 parts of wheat. Ever since 1915, Maurel has stood for and defended the necessity of an increase in "blutage" in France, for the very obvious reasons of economy.

The stand which he has taken has not remained without considerable opposition. Thus an orator in the Chamber of Deputies is quoted as saying: "Flour for man and the bran for the animals." Thus, in 1915, the "blutage" remained fixed at 74 per cent in France. Necessity, however, gradually increased it to 85 per cent, and Maurel states that the Austrians had increased it to 90 and the Germans to 94 per cent.

In his extensive investigations, Maurel obtained and examined three different classes of bread. The first was made from a "blutage" of 74 per cent, giving what he calls white bread (*pain blanc*); the second was procured from a "blutage" of from 75 to 85 per cent, giving his so-called brown bread (*pain bis*); the third class, made from a "blutage" of from 95 to 100 per cent, resulted in what he terms full bread (*pain complet*).

The conclusions arrived at are given in the following summary:

1. The nutritive substances from any given wheat are the greater in amount, the higher the percentage of the "blutage."

2. In dividing the different breads into three large groups: White bread, brown bread and full bread, experience has demonstrated that it is brown bread which is best utilized by the organism and the full bread least.

3. Brown bread, made of brown flour of good quality, is perfectly healthy; it is this quality of bread which agrees best with normal digestive tracts, that is, with the great majority of the people.

4. Full bread renders very efficient services in those with torpid digestive organs, prevents constipation and activates peristaltic action.

5. White bread favors constipation by diminishing peristalsis, but is indicated in abnormally excitable digestive organs.

H. G. Beyer.

"The Schick Test, with Especial Reference to the Negro," by Louis F. Wright. *Jour. Inf. Dis.*, September, 1917, Vol. 21, No. 3, pp. 265-268 (abstr. in Govt. Dis. Bull., by A. G. B.).

The Shick test, described in 1913, is defined as "a simple intracutaneous test that indicates whether or not the person tested possesses a natural antitoxic immunity to diphtheria" and the practical value of which has been generally established. The reaction is characterized by "a circumscribed area of redness and slight infiltration which measures from 1.0 to 2.5 cm. in diameter; this persists from 7 to 10 days and, on fading, shows superficial scaling and a persistent brown pigmentation." Out of 210 negroes tested 86, or 40.9 per cent, reached positively. On the dark skin the scales were white or grayish in color, and the darker the skin, the darker the pigmentation. It was concluded that the reaction is as clear cut in negroes as in whites and that adult negroes possess about the same degree of immunity as adult whites.

To the reviewer, there is in all this group of skin reaction, such as the tuberculin reaction of Von Pierguet, in the luetin reaction of Noyonchi and that the Schick, a common factor that would suggest a different interpretation from the one usually attached to them. All these reactions are spoken of as showing the presence of a preëxisting immunity, whether acquired or natural, against the disease in persons giving a positive reaction. This may, perhaps, be true in some cases, but the question may still be asked: Is this true for all the cases? May it not, in other cases, be, as it is in our vaccinations against smallpox, that these very positive reactions are, on the contrary, direct and positive indications of a susceptibility to the disease with the toxin of which they were inoculated; that the inoculated toxin was itself the direct active agent that had aroused or excited these reactions, by causing a mild form of the disease and, henceforth, leaves a form of artificial immunity behind, in apparent analogy to what happens in vaccinations for smallpox? In other words, the question is: Are these intracutaneous inoculations, after all, not rather a form of vaccination than merely a method of testing the immunity of persons against a disease?

H. G. Beyer.

Notes sur quelques manifestations de la Pneumococcie chezles Tirailleurs des camps de Fréjus et Saint Raphaël, by R. Benjamin. *Bull. Soc. Path. Extot.*, vol. 10. No. 9, November, 1917 (abstr. in Trop. Dis. Bull., vol. 11. No. 3, March, 1918, by A. G. B.).

According to Banjean, pneumococcus infection, and then tuberculosis, is the chief cause of admission to hospital and death at these camps in the south of France, and chiefly among the Senegalese, Malagasies and Somalis. The usual manifestations are pneumonia, bronchopneumonia, pulmonary congestion and bronchitis, with the frequent implication of the pleura and pericardium, but never the peritoneum. Among the other forms here described, six cases of pneumococcus-skin infections are of special interest because apparently new to literature. In four of these cases the face was the portion of skin affected, and here the lesions suggested erysipelas; in the other two there was a generalized eruption. Extreme swelling of the face was followed by the eruption, in crops, of small bullae; the enclosed fluid swarmed with pneumococci. After a few days they dried up and crusts separated; small abscesses sometimes followed. There was continued fever, 39 to 40° C., headache and delirium. In one case the phlyctenules covered the whole body, resulting in an acute pneumococcic pemphigus ending fatally. Pure cultures were obtained from the phlyctenules.

H. G. Beyer.

Spirochaeta icterohemorrhagiae in American Wild Rats and its Relation to the Japanese and European Strains. *Jour. Experem Med.*, May 1, 1917, vol. 25, No. 5, pp. 755-763 (abstr. Trop. Dis. Bull., vol. 11, No. 3, 1918, by R. P. C.), by Hideyo Noguchi.

The Wild Rats of the Southern States as Carriers of Spirochaeta icterohemorrhagiae. *Jour. Am. Med. Asso.*, November, 1917, vol. 69, No. 21, p. 1787 (abstr. in Trop. Dis. Bull., vol. 11, No. 3, 1918, by A. G. B.), by James W. Jobling and A. A. Eggstein.

Noguchi announces his success in isolating *Sp. icterohemorrhagiae* from the kidneys of American wild rats, obtained from the vicinity of New York City and in causing the death of guinea-pigs by injections of the isolated strains within 9 to 12 days. The morphology of the spirochete corresponds with that of the Japanese and Belgian strains and is described as "a closely worm, slender, cylindrical thread with gradually tapering ends, averaging 9μ by 0.25μ." The number of coils is stated to be greater for a given length than is the case with any known spirochete, being 10 to 12 coils within a length of 75μ. The organism being, moreover, devoid of a terminal filament, such as is characteristic of a spironema or treponema, and resistent to a 10 per cent saponin, unlike other spirochetes, Noguchi considers that it calls for a new name and genus and for which he propose the name *Leptospira*.

Jobling and Eggstein, having observed a case of infectious jaundice at Nashville, Tenn., examined a series of wild rats to ascertain whether they harbored *Spiricheta icterohemorrhagiae* and found this organism present in 10 per cent of the rats examined. The authors point to the importance of these findings, in view of the number of Americans undergoing trench training in these places.

H. G. Beyer.

Abstracts, Translations and Reviews of Recent Literature on the Subject of the Reconstruction and Reëducation of the Disabled Soldier War Department, Office of the Surgeon General. Eighty-four typewritten pages, illustrated.

Bulletin No. II, bearing the date of March 15, 1918, contains a most carefully selected collection of abstracts, translations and reviews on the subject, the knowledge of which it is intended to impart to those especially interested in it. Under its fourteen headings, it would seem that every phase of the sad and difficult problem of the reconstruction and the reëducation of the handicapped soldier is included and finds serious and adequate treatment. No post-bellum problem, it would seem, will require more originality, greater versatility, sounder pedagogy combined with more persevering patience and saner human sympathies than that which has been approached in the present bulletin.

The vexed question as to whether civilian or medico military control of the disabled soldier during his rehabitation and placement should

be made to prevail is as important as its decision is difficult and fundamental at the same time. Admitting, as we must, that coöperation between medico-military men and civilians is a necessity in the problem, we may, further, admit that such coöperation, to be successful, will depend as much, if not more, on the quality and caliber of the coöperators, on the two sides, than on whether they are medico-military men or civilians. Both sides being supposedly *thoroughly* impressed and animated by the sole and exclusive desire of procuring, by all available means and methods, the greatest good to the greatest number, in the shortest possible time and in the most humane fashion, offended personal pride and the human vanities, on the one hand, ought to yield to the higher ideals in force, and military discipline, on the other, be given the function of a simple but absolutely necessary *therapeutic* measure and be recognized as such, as controlling, for the time being, all hands, officers, civilians as well as patients, until the prime object, that of restoring the poor disabled soldier to a useful and enjoyable life, will have been attained. An impersonal, all-controlling super-humanized discipline, best administered by those whose life has been steeped in its principles and exercised in practice, would seem, to the reviewer, to offer the only probable solution of this important question. An intensive study of the contents of the bulletin could not be too highly recommended.

H. G. Beyer.

BOOK REVIEWS

REVIEW OF WAR SURGERY AND MEDICINE, Vol. I, No. 2, Washington, 1918, pp. 69. Prepared in the Office of the Surgeon General.

The work represents a summary and a digest as well as a guide, pointing with commendable brevity and directness to the accumulated treasures in our knowledge of war medicine and surgery, gained up to the present time.

Contents.—Practical Points on Use of Immobilization in War Surgery; The Treatment of Wounds; Surgical Treatment of War Wounds of the Abdomen; Wounds of Joints; The Repair of Face and Jaw Injuries; Abstracts from Oto-Laryngological Literature; Abstracts from Ophthalmological Literature; Laboratory Studies of Pneumonia; Laboratory Studies of Meningitis; Vaccines; Parasites.

At the head of this summary we find: "*Practical Points on the Use of Immobilization in War Surgery.*" The reviewer believes that this has been done advisedly. For it must, by this time, have become universally recognized by all military surgeons, whether occupied at the front or in the rear of the battle line, that their former peace courses in bandaging, their instruction in the methods of immobilization of injured parts were lamentable failures, utterly inadequate to war conditions and war transportation methods. Hence the urgent necessity for reforms in this field of instruction and the very justifiable emphasis put upon it in the present number.

The second section of the number gives the methods and result of the "*Treatment of Wounds*" with a critical and very fair arraignment of the respective values of antiseptics so far employed with partial success. Among these, Haycraft's methods of treatment of wounds with simple soap solution appears as looming up with unexpectedly favorable promises and prospects. "It follows from this that the tissues themselves are able to deal successfully with any infection which is left behind without the aid of any antiseptic." The biological truth contained in this sentence ought ever to be kept in mind. It is this potential, determinant power for repair, resident in the tissues themselves, the preservation of which should ever form the gravest concern on the part of the surgeon in his treatment of all injured parts, no matter where situated! The reviewer deems it superfluous to further circumscribe or underline the sections treating of special parts and special regions of the body; they must be allowed to speak for themselves.

"*Laboratory Studies of Pneumonia*"—"*a rapid cultural method.*" The ingenious method of Avery, again, still further simplified by W. T. Vaughan, through the elimination of white mice by the former, from the process of type determination in the pneumonias, must be regarded

as a decided advance over former methods. The application of the solvent action of oxbile of the pneumoccocci and the subsequent employment of precipitin tests, later supplemented by agglutination tests, are of special value when contrasted with previous, tedious and lengthy methods. The methods of Tchell and Muns, of Krumiede and Valentine must be considered as improvements in the same general sense.

The "*Rapid Method for Identification and Isolation of Meningococci from the Nasopharynx*" by Olitsky, through the employment of a fluid medium eliminating organisms merely resembling meningococci, in about 12 hours, and thus reducing the full time required for identification of the latter by at least one day, would be calculated to give the method a distinct advantage at a time when the determination of the true meningococcus carriers from the fake is such an urgent necessity. With reference to the question of the employment of an antimeningococcus serum in the final process of testing for special types, the reviewer is somewhat inclined to favor the use of univalent sera for the several types and absorption tests, after the method of Colonel Gordon, rather than that of polyvalent sera.

The experience on "*Meningococcus Infection and Meningitis,*" by Thomsen and Wulff, recorded in the number seem to be of considerable importance, offering much food for thought. They suggest to the reviewer the possibility of saprophytic meningococci living in the nasopharynx under unfavorable local conditions (locally produced antitoxins?), but becoming reactivated, by passing through coughing and sneezing, into more susceptible individuals and thus acquiring more virulent attributes by repeated passages through such individuals.

"*Vaccines.*"—The domain of research for vaccine is, without question, the promised land for the hopeful young investigator as well as the ultimate aim of all preventive medical efforts. If the claims for lipovaccines of Whitmore, Fennel and Peterson will be substantiated by future practical experience, we would then be in a position for recording a quite considerable advance in the history of vaccination and one of enduring value.

The author's claims for the advantages of lipovaccines over aqueous vaccines, as given in the number under consideration, are as follows: "(1) Diminution of local and systemic reactions; (2) the feasibility of giving sufficient vaccine at a single injection properly to immunize the individual; (3) the persistence in the individual of a focus from which the immunization process over a period of several months with a resulting lengthening of the period of immunity; (4) the actual detoxicating effects of certain lipoids that can be incorporated in the vaccine; (5) the prevention of autolysis and deterioration of the vaccine."

"*Parasites.*"—Of all the parasites, perhaps the most repugnant to our clean and tidy American soldiers, even if they are not considered the most dangerous to life, lice take the first place, at least, if we are

to judge by the very general interest, already aroused, in "antiparasitic vests, made of butter muslin, dipped in a solution of an ounce and a half each of naphthalene and sulphur in pure powder, to one gallon of benzine and petrol, 24 hours being allowed for solution" and recommended by Gunn. Naphthalene, perhaps the most essential substance in this mixture, as well as the resulting sulphurous acid being, however, both volatile, the reviewer may be pardoned for entertaining some doubt as regards the permanency and consequent dangerous reliability of the depediculizing attributes of any such garments, that will, no doubt, be vigorously pushed into the market by our enterprising and not overscrupulous manufacturers.

H. G. Beyer.

An Introduction to the History of Medicine, by Fielding H. Garrison, A.B., M.D., Principal Assistant Librarian, Surgeon General's Office, Washington, D. C. Second edition, revised and enlarged. Philadelphia and Boston: W. B. Saunders Company, 1917. A book of 791 pages, with appendices and an index.

The author, placed by simple fortune for many years in the Surgeon General's Library at Washington, the great center, *par excellence*, for the reception of medical works and of the best medical thoughts from all over the civilized and uncivilized world, and, in constant daily contact with these, by nature as well as education, a close student of his environment, he could not have made better use of his opportunities than write a history of medicine. The quite apparent success of the venture speaks volumes for both the good judgment of the author and the specific value of his milieu.

The medical student with some experience of his own, on opening this book and on perceiving what the author puts before him in the very first paragraph regarding "the unity or solidarity of folk-lore," will probably, like the reviewer, have his thoughts turned, instinctively, in the direction of that still distant, though slowly but surely, approaching goal of the final establishment of the great and infinite *oneness* of all things scientific to which all truly accredited and enduring humanly discovered laws in the sciences are winding or zigzagging their ways and must in the end arrive at.

All present-day histories recorded by human minds must naturally be still imperfect and remain more or less incomplete. The long, fine, as yet imperfectly revealed threads in the network of past human events and endeavors, the ideals animating these, spread out over aeons of time, show burials, eruptions, gaps and deficiencies still to be disinterred, interpreted or to be filled out. The important events recorded, the epoch-making discoveries, left us by the great luminaries in the profession are but the indestructible truths, the time-resisting spores, the Gordian nodal points in the continuity of that portion of the great fabric still hidden under the débris of past ages. The fine-spun but

threadbare and transparent philosophical patches of the mystics may for a brief time cover up deficiencies, the ephemeral products of the imagination or the more selfish designs of the charlatan and quack may blind for a short time the normally clear vision of the human understanding, but will never again succeed in entirely obscuring it.

Just as the palaeontologist is endeavoring and is slowly but surely succeeding in the filling out the tremendous gaps still existing in the phylogeny of living things in general, just so the medical historian must continue to search for the undiscovered threads and links still missing in the continuity of the normal and orderly growth of his science. Such an explorer will probably soon find that an author, undertaking today the writing of a history of medicine, comes very close to proposing to himself the writing of a history of the sciences.

The history of medicine might, not inaptly, be compared to that of the vigorous growth of a gigantic tree, deeply rooted and implanted in a world of living things, and from which a modern medical education would simply mean the harvesting of the accumulated fruits of thousands of years. Indeed, the true interest of the present-day physician in his profession, can be aroused and strengthened as time goes on in no better way than by a study of its history. It certainly seems that it ought to be so. In learning what has been done and in what still remains to be accomplished, he will realize his own relation to the whole, never fail in giving due credit to those who worked for his education in the forgotten past and in properly evaluating the modest contribution he may have been fortunate enough to add to it himself.

Page 15 in this book is covered by a resplendent posy of some of the choicest expressions of thought of some of the best, noblest and most revered in the profession, clothed in the finest words in the language.

"Identity of Forms of Ancient and Primitive Medicine" reads like a romance playing from the most ancient mythical up into modern times, connecting the earliest historically recorded superstition with the very latest triumphs of experimental physiology and psychotherapy.

Under "Egyptian Medicine," where the author, among other things, traces the descent of man from prehistoric times through the discoveries of the skeletal remains of human fossils found at Neanderthal (1856), Crô-Magnon (1868), Spy (1887), Krapina (1899), Heidelberg (1907), Le Moustin (1908), La Chappelle-aux-Saints (1908), and the recent Pittdown find (Eoanthropus Dawsoni, 1911), and where he, finally, brings to bear the "precipitin" test on the question of blood relationship, he evinces an attempt at thoroughness and completeness, both of which are original as well as characteristics of his work throughout the book. The rather copious references to original contributions from which the author has drawn his information clearly point to the experienced librarian as well as to the well-rounded scholar who knows the sometimes devious ways of finding what he needs to know before putting his pen to paper.

Under the caption of "Sumerian and Oriental Medicine," we read of the very close connection, in point of time, with the medicine of the Jewish people, among which the priests acted as hygienic police in relation to contagious diseases, "though there is not a single reference to priests acting as physicians." "How highly the physician was esteemed by the Hebrews of a later time may be gathered from the impressive language of Jesus, the son of Sirach (180 B. C.): (1) Honor a physician according to thy need with the honors due unto him: For verily the Lord has created him. (2) For from the Most High cometh healing: And from the King he shall receive a gift. (3) The skill of the physician shall lift up his head: And in the sight of the great men he shall be admired."

Not a few of the readers of this history may probably be surprised at learning that, for India, the Susrata describes about 121 different surgical instruments, including scalpels, lancets, saws, scissors, needles, hooks, probes, director's, sounds, forceps, trocars, catheters, syringes, bougies and a rectal speculam," and that the Chinese were early acquainted with the identification by finger-prints (dactyloscopy). How fragmentary and backward in other respects Chinese medical education is, even quite up to recent times, was witnessed by the reviewer in 1906, when he found in a Chinese medical college at Canton that the students were still learning anatomy from books and drawings, instead of by dissection, owing to the perpetuation of certain traditional superstitions regarding the sacredness of dead bodies.

The author sums up what we owe to Oriental medicine by stating: "The Babylonians specialized in the matter of medical fees, the Jews originated medical jurisprudence and public hygiene and ordained a day of weekly rest, and the Hindus demonstrated that skill in operative surgery which has been the permanent possession of the Aryan race ever since."

Most impressive reading will be found in what the author has to say under "Greek Medicine," which is treated in three sections: (1) Before Hippocrates; (2) the Classic Period 460–146; (3) the Graeco-Roman Period (146 B. C.–446 A. D.). These are followed by treatises of the Byzantine Period (476-732 A. D.), the Medieval Period (1096-1438)—one of the largest and most interesting—leading up to the period of the Renaissance and through the different centuries up to present-day medicine, and where the not too young and inexperienced medical reader will begin to find himself among his own contemporaries, and where, perhaps also, he may find his own place, as a diminutive cog, in one of the smaller wheels of the complicated machinery of progress in his profession.

The superb collection of fine photographs of the great luminaries, both ancient and modern, of the profession is by no means the least valuable part of the book, and must have put the author to the test of great patience and painstaking labor. The reader, arriving at the end

of this truly great book, may possibly feel like one having passed a night in mystic, mythological dreaming and waking up to the daylight at last of a sterner and all too realistic present state of conscious existence. This is a book in which those who wish to know the things that were and the things that are may read and learn.

H. G. Beyer.

A Clinical Treatise on Diseases of the Heart, for the General Practitioner, by Edward E. Cornwell, Ph.B., M.D. New York: Rebman Company, 1917, 127 pages.

The author states in his preface that this little book is written for the general practitioner and is intended to be neither an exhaustive treatise nor a compendium. It is meant to deal in a brief and practical manner with the more important elements of diagnosis and treatment of diseases of the heart. It is divided into two parts, the first being devoted to diagnosis at large and the second to treatment. The book presupposes a familiarity with general anatomic and physiologic considerations, but attempts nothing more than a presentation and discussion of the essentials of the subject from the purely clinical standpoint.

Most of Part I is devoted to the nature of the physical signs and the manner of eliciting them, together with a description of the predominating cardiac disturbances. In discussing the question of arrythmias, the author's self-imposed limitations introduce a difficulty, in that it is impossible to present clearly the nature of the arrythmias without a consideration of the features developed by pulse tracings and the electro-cardiograph, all reference to which is omitted. For this reason the sections of Part I relating to the easily understood forms of heart disease, such as the common valve lesions, will prove of the most value to those readers for whom this work is intended.

In Part II, under "General and Special Therapeutics," the author lays considerable emphasis upon dietetics, which is detailed at greater length than the size of this work justifies. Here and elsewhere the author "has not hesitated to express his own views," as he states in the preface, but it would appear desirable to have given more space to the consideration of digitalis, which suffers by comparison in regard to the attention given it. The author leans rather strongly to the use of strophanthin in preference to digitalis, and it is a debatable point whether a book so limited as this in subject matter and discussion should present anything other than the orthodox dictates of the profession at large.

There is one illustration, which is diagrammatic of the relation of murmurs to the heart cycle.

It may be said that the author has well accomplished his purpose of

providing a simple and practical handbook for the busy country practitioner who, recognizing a deficiency in his equipment for diagnosing and treating heart disease, desires to rectify it. The language is simple and clear and the style excellent.

WARFIELD T. LONGCOPE.

LA PRATIQUE DE L'HYGIENE EN CAMPAGNE, by Andre Tournade, Professeur agrégé des Facultes de Médecine, Ex Répétiteur du Service de Santé Militaire. Médicin-Major de 2e classe au 19e Batallion de Chasseurs á pied. Paris: Imprimerie-Libraire Universelle, L. Fournier, 1916.

This convenient little handbook is eminently practical and could easily be carried in the pocket. The subjects are treated in alphabetical order. It is, in a sense, a kind of formulary recalling easily to one's mind the principles of hygiene, giving at the same time their application to present military conditions in Europe.

FRANCIS M. MUNSON.

DISASTERS AND THE AMERICAN RED CROSS IN DISASTER RELIEF, by J. Byron Deacon, General Secretary, Philadelphia Society for Organizing Charity (on Leave of Absence), Divlsion Director of Civllian Relief for Pennsylvania. New York: Russel Sage Foundation, 1918. Price 75 cents.

The purpose of this book is to interpret the experience of the Red Cross in disaster relief in terms of the problems met, of the methods that produced the best results, and of the principles upon which such results were based, doing all this for the benefit of those who will have to deal with future disaster relief operations.

This purpose has been most admirably carried out. A chapter is given to the principles of disaster relief, one to organization for disaster relief, and one each to disasters at sea, coal mine disasters, floods, fires and tornadoes. The sanitary side of disaster relief is dwelt upon where indicated and the social and financial phases of relief work are thoroughly discussed. There are two appendices, one containing the regulations recommended by the Illinois State Board of Health for the prevention of sickness after floods, and the other the general policies and regulations governing a system of disbursement and accounting for the Ohio Flood Relief Commission Funds and the funds of the American Red Cross to be expended in Ohio. There is a good index.

FRANCIS M. MUNSON.

DISEASES OF THE SKIN—THEIR PATHOLOGY AND TREATMENT, by Milton B. Hartzell, A.M., M.D., LL.D. 51 color plates and 242 cuts. Philadelphia and London: J. B. Lippincott Co., 1917. Price, $7.

This is a new work in its first edition. The description of the various diseases is based largely upon the author's own experience in derma

tology and general medicine, although he also presents the views of other writers with which, however, if he differs, he presents also his own views.

It would seem from the author's preface to be a work presenting a personal description of the diseases as well as an expression of personal views rather than an impartial presentation of dermatology as a subject. It appears more as a system or set of concise, well-written lectures than as a comprehensive text-book, and for this reason will probably be favored by students.

The diseases are classified according to character and type and grouped into chapters after this arrangement. The general arrangement of the book would support this. The text seems carefully and concisely written, though because of the style may not be easily grasped without close or repeated reading. While there are many illustrations which are helpful, yet many are not so satisfactory as one would wish in a text-book, and a greater number might reasonably be expected to accompany so brief a text. The colored plates are remarkable, not only in their tones and reality, but also in that the lesions appear as if stereoscopic, or as the actual case in clinic.

A reasonable presentation of very satisfactory treatment is given with actual prescription where thought necessary.

The reviewer does not consider the book sufficiently comprehensive as a reference book, but rather as a compilation of preliminary lectures or students' text-book.

The book is printed on a high glazed paper making not only a very heavy book, but also one difficult to read because of the light effects on the eye.

W. E. Eaton.

Diseases of the Digestive Organs, with Special Reference to Their Diagnosis and Treatment, by Charles D. Aaron, Sc.D., M.D. Detroit, Mich. Price, $7.

This book is an extremely well-prepared volume on diseases of the digestive tract, going minutely into the practical laboratory tests, thus making it a volume of merit for the profession and the undergraduate.

The volume contains fifty-four chapters embracing the physiology of digestion, many excellent illustrations, and a chapter devoted to Roentgen-ray examinations of the gastrointestinal tract. The reproductions are exceptionally illuminating and make a valuable addition to this edition.

Etiology, symptoms, diagnosis, and treatment are clearly presented and in such a manner as to bespeak very careful observation and study.

Camp Stanley.

Les Blessures de l'Abdomen, par J. A. Abadie (d'Oran). Deuxieme edition, Précis de Médicine et de Chirurgie de Guerre, published by Masson & Co., Paris, 1917.

The publishers, Masson & Co., are to be congratulated on bringing out a series of short monographs written by specialists who are having wide opportunities as participants in the up-to-date progress of medicine and surgery in this latest and greatest of all wars. The publishers do not claim that these books contain the final word. "This will be the task of tomorrow, in the silence and repose which belong to scientific work."

The distinguished surgeon, Prof. J. L. Faure, of Paris, writes the preface and pays the highest compliment to the ability of the author as a bold, clear-thinking, experienced surgeon, one capable of analyzing not only his own large experience but that of his colleagues; and it is to be noted that Abadie's conclusions in the treatment of wounds of the abdomen agree with those which have very recently been formulated by the Société de Chirurgie de Paris, in a unanimous vote, viz., operate as early as possible when appropriate conditions admit.

The book is divided into three parts: Part I, What is the Treatment of Choice in Penetrating Wounds of the Abdomen; Part II, In what Conditions is the Treatment of Choice Applicable; Part III, The Treatment to be Followed in the Presence of a Penetrating Wound of the Abdomen.

Abadie gives a brief history of the development of the recognized surgical practices in gunshot wounds of the abdomen in civil life, *i. e.*, systematic intervention. He takes up the facts and conclusions based upon experiences in former wars, including those of the Balkan War just preceding the outbreak of the present war, in which he shows that great differences of opinion existed as to the advisability of non-operative or operative interference. He says in substance, that since the comparative safety of the operative procedure of abdominal section itself has been widely acquired by surgeons the world over, there have in war surgery been few opportunities for a fair comparative study of intervention or non-intervention in wounds of the abdomen. The instability of the military hospital because of the nature of the campaigns did not permit of the establishment of relatively permanent well-ordered operating units. Either the work was not done as it should have been, selective, operative, and after-care, or else the hospitals were so far to the rear that the injured were admitted too late after being wounded, for the expectations of successful surgery to be realized. He admits that recoveries by abstention from operation are undeniable, but reminds us that the nature of the injury, except when accompanied or followed by fistulization, is always speculative. He mentions the general acceptance of the edict to follow the aphorism of MacCormac, who, referring to the Boer War, said, "A man wounded in the abdomen dies in this war if he is operated upon, and he may live if he is left in

peace." This is interesting to the reviewer who very well remembers reading the series of papers by MacCormac and J. Marion Sims, published in the *British Medical Journal* very early in the eighties, in which they advocated surgical intervention in gunshot wounds of the abdomen. This recommendation was based upon their observations and experiences in the siege of Paris during the Franco-Prussian War. It was this series of papers that stirred up the surgical world in America and led to the first successful operative intervention by the late Dr. William T. Bull, in a case of gunshot wound of the abdomen with multiple perforations of the small bowel.

Abadie tells us that an administrative circular dated October 15, 1914, was issued, calling the attention of army surgeons to the effect that medical treatment was to be relied upon in the treatment of wounds of the abdomen and that any surgical intervention was to be limited to the so-called Murphy operation, *i. e.*, suprapubic incision and pelvic drainage. Some surgeons, however, believing that there was something better to do and that laparotomy merited being again tried, put it into practice, but their results were not encouraging; in fact, this continued to be the case until the nature of the fighting admitted of the essentials for any good surgery, as gauged by results, viz., the establishment of operating station hospitals near enough to the firing lines to admit of the early transportation of the wounded to these hospitals, and the organization of especially trained staffs to make the diagnosis, to exercise judgment in the selection of operative cases, to carry out the technique skillfully and expeditiously, and to direct the after-treatment.

It has been in the improvement of all of these essentials that the treatment of gunshot wounds of the abdomen in war surgery has found its place, and nowhere will the American surgeon find the subject better told than in this précis by Abadie. The subject of anatomical lesions is well discussed. Attention is called to the fact that the nature of the projectile very seriously sometimes determines the gravity of the lesions and that in this war, for the first time, wounds from shell fragments are eclipsing all others in importance, as well as the same types of injuries from bombs and the projectiles of the numerous trench engines. Wounds from side-arms are exceptional and there have been practically no abdominal sabre wounds reported—the nature of the fighting has determined this. Also bayonet wounds of the abdomen, at least among the French, are very exceptional. (Abadie has seen only three such among 3,500 wounded.) His experience embraces 479 observations by laparotomy. Among them there were 3 bayonet wounds, 147 bullet wounds, 271 from shell fragments, and 58 from hand grenade fragments. Of the 147 cases of bullet wounds, there were 81 cures—a mortality of 45 per cent. From the bomb wounds, 58, there were 31 cures—47 per cent, and from the 271 shell fragment wounds there were 94 cures or 66 per cent. Did space permit it would be interesting to further study,

the anatomical lesions produced by these different missiles, and what the author's experience teaches him of the indications which he considers essential for the successful conduct of war surgery of abdominal wounds. His studies of the general diagnostic and surgical indications for intervention are practically the same as those recognized by civil surgeons, and they are very painstakingly described.

As to the essential of the radioscopic study of gunshot wounds of the abdomen in war times, Abadie has this to say: "all army surgeons have not at their disposition a radioscopic installation"—that a portable apparatus is not always at hand. In times of stress, even with a fixed installation, the surgeon is often forced to make a decision and to operate without having the time to have his patient passed under the screen. The clinical examination ought then to suffice. Abadie recognizes the great value of the X-ray in the location of foreign bodies—those remaining in the abdominal cavity or having passed through into the tissues beyond—and explains methods employed by him for their exact localization and removal.

There is an excellent chapter on technique of operation, most advantageous incisions to employ, the methods of repairing wounded viscera, either by suture or resection.

It is also to be noted that he illustrates and describes the most recent method—that of Pauchet—for approach to the posterior wall of the stomach by the inter-colo-epiploic route which the reviewer from personal experience can highly recommend.

Finally, the book closes with a chapter on medical treatment, which is summarized in the following way: Absolute immobility; abstention from all food; Fowler position, Murphy rectal drip; hot, moist compresses to the abdomen; hypodermic administration of morphine and camphorated oil.

For post-operative complications, the author recommends, in suitable cases, ileostomies and colostomies, the drainage of localized peritoneal abscesses, and the removal of foreign bodies recognized by radioscopy and perhaps by local infection.

In this précis will be found the whole subject of war wounds of the abdomen discussed in an up-to-date, concise, logical manner, and its perusal will add to the knowledge of any surgeon, however great his experience. Particularly can it be recommended to those whose knowledge of the treatment of these wounds is alone based upon civil practice.

Jno. E. Summers.

The Surgical Operations on President Cleveland in 1893, by Wm. W. Keen, M.D., LL.D., Emeritus Professor of Surgery, Jefferson Medical College, Major Medical Reserve Corps, U. S. Army. Philadelphia: George W. Jacobs & Company, 1917.

This is a republication in book form of the article published in the *Saturday Evening Post* of September 22, 1917, and is an interesting contribution to the

political, financial and surgical history of our country. A skillfully kept secret is now authentically told for the first time. The deep-seated financial storm and the impending special session of Congress of the summer of 1893 had made the continuance of the life of President Cleveland a vital necessity to the country. His death at that time or even a general knowledge of the actual facts pertaining to his physical condition would have been a national disaster, as his sterling, rock-ribbed personality was needed to check the free-silver fallacy, then rapidly gaining headway in Congress.

The operations were performed for the removal of a sarcoma of the upper jaw and were done on board Commodore Benedict's yacht, the *Oneta*, by Dr. Joseph D. Bryant, President Cleveland's medical attendant and intimate friend, assisted by Dr. Keen and Dr. J. F. Erdman. Dr. R. M. O'Reilly, later Surgeon General of the Army, gave the anesthetic and Dr. E. G. Janeway kept watch upon the patient's pulse and general condition. Dr. Ferdinand Hasbrouk, a dentist, also assisted.

"The entire left upper jaw was removed [after preliminary extraction of the two left upper bicuspid teeth] from the first bicuspid tooth to just beyond the last molar, and nearly up to the middle line. The floor of the orbit—the cavity of the skull containing the eyeball—was not removed, as it had not yet been attacked. A small portion of the soft palate was removed. This extensive operation was decided upon because we found that the antrum—the large, hollow cavity in the upper jaw—was partly filled with a gelatinous mass, evidently a sarcoma. This diagnosis was later confirmed by Dr. William H. Welch, of the Johns Hopkins Hospital, who had also examined the former specimens.

"The entire operation was done within the mouth, without any external incision, by means of a cheek retractor, the most useful instrument I have ever seen for such an operation. This retractor I had brought back with me from Paris in 1866. The retention of the floor of the orbit prevented any displacement of the eyeball. This normal appearance of the eye, the normal voice, and especially the absence of any external scar, which was the most important evidence of all, greatly aided in keeping the operation an entire secret."

A second operation, to remove some suspicious tissue, was performed under the same circumstances seventeen days after the first one.

Mr. Cleveland was fitted with an artificial jaw of vulcanized rubber by Dr. Rosslyn C. Gibson, of New York. This supported the cheek in its natural position and prevented it from falling in. When it was in place the President's speech was excellent, even its quality not being altered.

President Clevelend died June 24, 1908, fifteen years after the operations. His survival for this length of time after the removal of a sarcoma of the jaw is a tribute to the great surgeons who performed the operations.

FRANCIS M. MUNSON

INSTRUMENTS AND APPLIANCES

A TENT FOR SANITARY UNITS

(With one illustration)

Lieut. Col. W. L. Hart, M. C., U. S. A., submits the following:

Service in Mexico with Field Hospital Company No. 7 brought forcibly to my attention the faults in certain parts of the tentage which now pertains to sanitary units. In order to obviate these faults, as I see them, I would advise a modified ward tent to replace the present hospital tent in field hospitals and other units. No claim to originality is made, as the proposed tent is merely the adaptation of the excellent qualities of the present ward tent to meet other needs. The objection has been raised to this tent that it would add another tent to the long list which the Quartermaster Department now furnishes. I have borne this in mind, but have come to the conclusion that the tent which I propose, offers enough advantages to warrant the addition.

Before we go further, let me say a few words about our present "ward tent." It is the best tent the Medical Department has ever had, weight and capacity considered. We know that it is 50 feet by 16 feet in floor area and has a normal capacity of 36 beds, with a space of 2 feet 4 inches by 8 inches per patient. There are 7 feet between the door-pin and the first pole and 12 feet between each pole, which gives $7 + 12 + 12 + 12 + 7$ feet, or 50 feet. The M. M. D., 1916, par. 883 (wagon No. 3) states the weight of one ward tent, complete with cover for canvas, as 535 pounds. Assuming that each running foot of the tent would weight approximately the same, we have $535 \div 50 = 10.7$ pounds per running foot.

For my tent I take one panel, as it were, of the present ward tent, plus the two ends, giving me a tent $7 + 12 + 7$ feet, or 26 feet by 16 feet, weighing, on the basis of 10.7 pounds to the running foot, 280 pounds approximately. This weight, as in the case of the ward tent, includes pins, poles, etc. With a ground space of 26 by 16 feet, and allowing each patient 2 feet 4 inches by 8 feet (as is at present allowed in a ward tent), I would have a bed capacity of 18 patients, with a little space left over.

Paragraph 883 of the Manual tells us that a hospital tent, complete, weighs 320 pounds, and paragraph 886 that it has a bed capacity of 8 patients (allowing each patient 3 feet 9 inches by 7 feet); from which it will be seen that my tent, while saving 40 pounds in weight, will give two and a quarter times ($8 : 18 :: 1 : 2\frac{1}{4}$) the bed capacity. Even assuming that my weights are not correct and that the two tents would

weigh the same, any field soldier can at once see the advantage of the increased capacity without additional weight. Then, the difference between transporting a two-pole tent and a three-pole one (especially when one is a ridge pole), as is the case with the hospital tent) is not a small matter—but this will be discussed later.

Paragraph 872 of the Manual allows for a regimental hospital two hospital tents, complete (640 pounds, bed capacity 16); if the allowance were one of my proposed tents, the weight would be 280 pounds and bed capacity 18, or *a saving of 360 pounds, with a capacity of two more patients,* to say nothing of the greater ease of handling.

Paragraph 879 allows for a field hospital four hospital tents, complete (1,280 pounds, bed capacity 32, in addition to other tentage); if the allowance were four of my proposed tents, the weight would be 1,120 pounds, bed capacity 72, or *a saving of 160 pounds, with a bed capacity of 40 patients more.*

But the hospital tents of a field hospital are not ordinarily used to house patients, as those who are familiar with the unit well know, but are used: one for operating room and dispensary, one for office and receiving, one for storage, and one for kitchen, and so the bed capacity may be disregarded in this case.

We also know that hospital tents are unsatisfactory for the use to which they are now put, with the possible exception of the one used for the office, as the ground space is inadequate. A hospital tent is 14 feet by 15 feet, and has a ground space of 210 square feet; my proposed tent, being 26 feet by 15 feet, has a ground space of 416 square feet, or *206 square feet more, thus supplying this much-needed ground space with actually less weight.*

Paragraph 886 of the Manual allows for a camp hospital three hospital tents, complete (960 pounds, bed capacity 24); if the allowance were two of my proposed tents, the weight would be 560 pounds, bed capacity 36, or *a saving of 400 pounds, with a capacity of 12 more patients.*

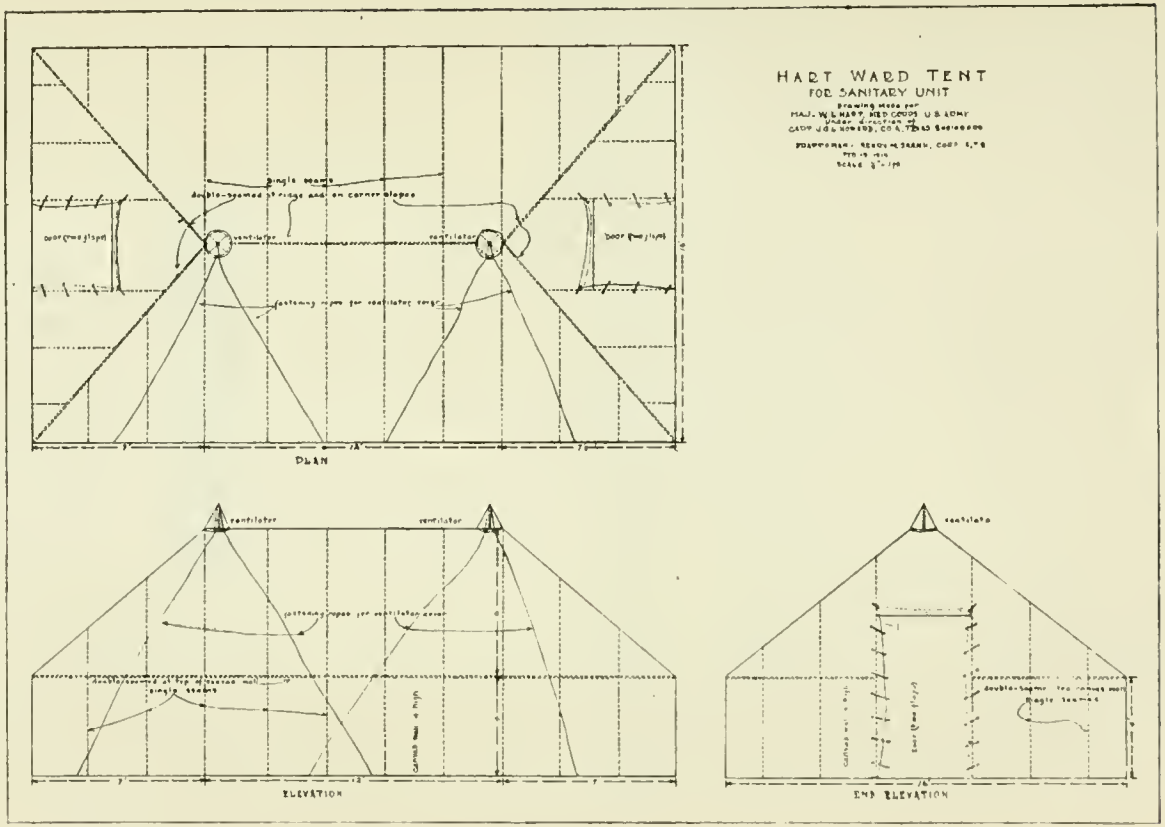
Some of the advantages of the proposed tent are:

(*a*) *Ease of transportation.*—By doing away with the unwieldly ridge-pole, the hardest single article in the equipment of a sanitary unit to transport.

(*b*) *Ease of pitching.*—It is much easier to pitch a tent of the circus type, under adverse circumstances, than one which has a ridge-pole.

(*c*) *Coolness in hot weather.*—When the sides are properly fanned out against the guy ropes, the slanting rays of the sun are cut out without interference with the wind and the amount of available shade is greatly increased.

(*d*) *Heating in cold weather.*—In cold weather the stovepipe can be run straight up from the stove through the vent, no elbow needed, thus making the heating apparatus more stable in windy weather,



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better draft, and the hot air which surrounds the pipe will create a forced ventilation through the vent.

(*e*) *Rainy weather.*—If the sides are fanned out, the rain cannot beat in; different from the hospital tent, which has to be battened down and rapidly becomes hot and stuffy, as all well know who have been tied up in them. Thus ventilation is not interfered with.

(*f*) *Increased capacity.*—But the greatest reason of all, and the one of paramount importance, is the increased capacity without increased weight.

(*g*) *Uniformity of tent pitching for sanitary units.*—A desirable factor.

(*h*) *Uniformity of poles.*—In doing away with the ridge-pole, we would only then carry one kind of pole—a tremendous advantage. If a pole should get lost or broken, another could be cut from the woods. This, of course, does not pertain when a ridge-pole is broken.

(*i*) *Stability in bad weather.*—Experience in the field has demonstrated that the ridge type of tent has not proven as stable in high windy weather as has the circus tent type.

(*j*) *Life of tent.*—I am of opinion, judging entirely from observation —I have no definite statistics available—that the circus type of tent will have a longer life than a tent of the ridge type, of course, being pitched under similar conditions.

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Obituaries

Those of our membership whose deaths have been noted since our last report are as follows:

Honorable Sir Frederick W. Borden, K. C. M. G.
Honorary member, died at his home in Canning, N. S., January 6, 1917.

Brigadier General B. J. D. Irwin, U. S. A., Retired.
Honorary member, died at his summer home, Coburg, Canada.

Major Joseph K. T. Van Pelt, U. S. V.
Died in Philadelphia, Pa., August 20, 1917.

Major Richard Weil, M. R. C.
Died at the base hospital, Camp Wheeler, Ga., November 19, 1917.

1st Lieutenant Henry S. Pascal, M. R. C.
Died November 17, 1917.

1st Lieutenant Sigmund Deutsch, M. R. C.
Died in New York City, November 29, 1917.

Major Z. Rousseau, U. S. V.
Died at Troy, N. Y., December 10, 1917.

Major Theodore C. Janeway, M. R. C.
Died at Baltimore, Md., December 27, 1917.

Captain E. M. Sheehan, M. C., N. G. U. S.
Died at Deming, N. M., January 12, 1918.

Captain Robert T. Gillmore, M. R. C.
Died at Camp Greenleaf, Ga., January 20, 1918.

1st Lieutenant George J. Brand, M. R. C.
Died at Camp Doniphan, Okla., February 11, 1918.

Captain Frank S. Pratt, M. R. C.
Died at Fort D. A. Russell, Wyo., February 12, 1918.

1st Lieutenant Harold F. Mickley, M. R. C.
Died at Camp Dix, N. J., March 16, 1918.

Major Charles S. Turnbull, M. C., N. G. Pa.
Died at Philadelphia, Pa., February 21, 1918.

Captain Deyer J. Jenkins, M. R. C.
Died at Union Co., Ohio, March 19, 1918.

Lieutenant Colonel William W. Reno, M. C., U. S. A.
Died at sea, March 21, 1918.

Major Lawrence S. Eckels, M. C., U. S. A.
Died April 2, 1918.

Captain Augustus De G. Green, M. R. C.
Died at Camp Lewis, Wash., April, 1918.

Captain Harry J. O'Brien, M. C., N. G. U. S.
Died at Fort Snelling, Minn., April 3, 1918.

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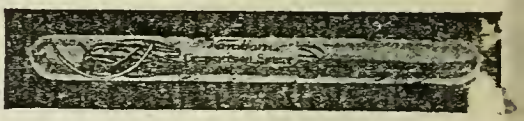

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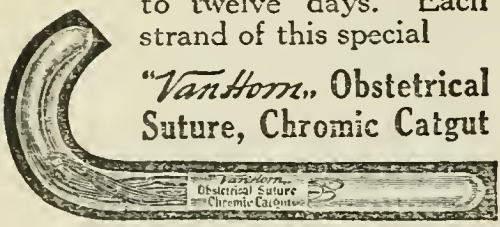

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